Biblioteca Internazionale dell'Ingegnere

G. A. BREYMANN

TRATTATO GENERALE
DI
COSTRUZIONI CIVILI
CON CENNI SPECIALI
INTORNO ALLE
COSTRUZIONI GRANDIOSE

VOL. III.
COSTRUZIONI IN FERRO

DEL

PROF. OTTO KÖNIGER

tradotta sulla sesta originale
Dall'Ing. VINCENZO MELE

CON NOTE
DELL'ING. PROF. PAOLO BOUBÉ

QUARTA EDIZIONE ITALIANA
CON APPENDICE D'AGGIORNAMENTO
DELL'ING. LUIGI VITTORIO ROSSI
Professore di Costruzioni nella R. Scuola d'Ingegneria di Padova

Con 634 inc. inter. nel testo e 98 tavole

CASA EDITRICE
DOTTOR FRANCESCO VALLARDI
MILANO
BOLOGNA — CAGLIARI — CATANIA — FIRENZE — GENOVA
NAPOLI — PADOVA — PALERMO — PISA — ROMA — SASSARI — TORINO — TRENTO — TRIESTE

BUENOS AIRES — MONTEVIDEO — RIO JANEIRO — S. PAULO

1925

PROPRIETÀ LETTERARIA

Stabilimenti Riuniti d'Arti Grafiche — Milano-Appiano.

Pierino Traverso

TRATTATO GENERALE

DI

COSTRUZIONI CIVILI

CON CENNI SPECIALI

INTORNO ALLE

COSTRUZIONI GRANDIOSE

INDICE DELLE MATERIE

Pag.

INTRODUZIONE 1

CAPITOLO I. — **Il ferro come materiale di costruzione.**

§ 1. Diverse specie di ferro e loro proprietà 3
§ 2. Dei metodi per l'estrazione del ferro dai suoi minerali 4
§ 3. Dell'affinazione delle ghise ivi
§ 4. Lavorazione del ferro e dell'acciaio 6
§ 5. Uso del ferro nelle costruzioni civile ivi
§ 6. Esame del materiale 7
§ 7. Appalto delle costruzioni in ferro 9
§ 8. Protezione delle costruzioni in ferro contro la ruggine 10
Protezione delle costruzioni in ferro contro gli incendi [v. Appendice V n. 1 pag. 466]

CAPITOLO II. — **Calcolo delle costruzioni civili.**

§ 1. Scopo del calcolo 11
§ 2. Diverse specie di carichi nelle costruzioni edilizie. 12
a) Peso proprio ivi
b) Carichi dei tetti 13
c) Sovraccarico dovuto alla neve ivi
d) Pressione del vento ivi
§ 3. Punti di applicazione dei carichi e classificazione delle travi 14
§ 4. Poligono delle forze — Prima condizione di equilibrio 15
§ 5. Poligono funiculare — Seconda condizione di equilibrio 17
§ 6. Coppie e momenti 18
§ 7. Determinazione dei momenti e delle pressioni negli appoggi in solidi rettilinei sollecitati da carichi verticali 20
§ 8. Carichi uniformemente distribuiti 25
§ 9. Forze interne — Tensioni 26
Forze interne e comportamento elastico resistente del materiale [v. Appendice V n. 2 pag. 466]
1. Resistenza normale 28
2. Resistenza alla flessione ivi
3. Resistenza al cesoiamento ivi

Pag.

4. Resistenza alla torsione 28
§ 10. Resistenza normale 29
§ 11. Resistenza alla flessione 31
§ 12. Resistenza composta 38
1. Resistenza delle travi ivi
2. Carico non baricentrico ivi
3. Resistenza alla flessione 39
§ 13. Centri di gravità di alcune superfici 40
Resistenza delle pressoflessioni [v. Appendice V n. 3 pag. 468].
§ 14. Momenti d'inerzia di alcune superficie 42

CAPITOLO III. — **Collegamenti.**

§ 1. Diverse specie di collegamenti 48
§ 2. Chiodature ivi
§ 3. Numero e diametro dei chiodi 50
§ 4. Distribuzione dei chiodi 53
§ 5. Coprigiunti 55
a) Giunzione delle lamiere e dei ferri piatti . . ivi
b) Giunzione dei cantonali e di altri ferri speciali 56
§ 6. Collegamenti di estremità ivi
a) Collegamento delle travi 57
b) Nodi ivi
§ 7. Viti e bulloni ivi
§ 8. Uso e calcolo dei bulloni 58
§ 9. Articolazioni 59
Calcolo delle articolazioni 60
1) Manicotto articolato 61
2) Articolazione di estremità di un tirante . . ivi

CAPITOLO IV. — **Sostegni.**

§ 1. Materiale a forma della sezione 64
§ 2. Sostegni in ghisa 65
§ 3. Sostegni in ferro 70
a) Colonne cave in ferro ivi
b) Sezioni rettangolari 71
c) Sezioni a croce 72
§ 4. Calcolo dei sostegni sollecitati da un carico baricentrico 74

Pag.

§ 5. Calcolo dei sostegni sollecitati da carichi non baricentrici 76
§ 6. Calcolo dei sostegni sollecitati da forze orizzontali. 80
§ 7. Piastra di base e fondazione dei sostegni sollecitati da carichi baricentrici 81
a) Spessore della piastra. 83
b) Nervature di rinforzo. ivi
§ 8. Piastra di base e fondazione dei sostegni sollecitati da forze orizzontali o da carichi non baricentrici 85
a) Dimensioni della piastra di base. 86
b) Calcolo delle nervature 88
c) Chiodi fra le nervature e il fusto della colonna ivi
d) Calcolo dei pilastri di fondazione ivi
§ 9. Appoggio delle travi sui sostegni 91

Capitolo V. — **Travi a parete piena.**

§ 1. Materiale e forma della sezione. 94
§ 2. Travi semplici 95
§ 3. Travi composte. 96
a) Anima. 97
b) Cantonali. 98
c) Piattabande ivi
§ 4. Generalità sul calcolo delle travi 99
Momenti flettenti e pressioni negli appoggi nelle diverse specie di travi 100
§ 5. Trave libera. 102
a) Carichi isolati ivi
b) Carichi permanenti. 103
c) Spessore della muratura ivi
§ 6. Trave appoggiata nelle due estremità 107
a) Carichi isolati ivi
b) Carico uniformemente ripartito 108
§ 7. Travi appoggiate in punti differenti dagli estremi. 111
a) Trave libera appoggiata in un punto diverso dalla sua estremità ivi
b) Travi appoggiate in due punti a distanza dagli estremi 114
§ 8. Travi collegate a cerniera (trave di Gerber) . . ivi
§ 9. Travi continue 120
§ 10. Determinazione della sezione. 123
§ 11. Appoggio delle travi sulla muratura 129
1. Piastre di appoggio. ivi
2. Dimensioni delle piastre 130
3. Commessura tra la piastra di appoggio e la pietra 132
4. Appoggi in pietra ivi
5. Muratura delle travi. ivi
6. Dimensioni dei pilastri in muratura . . . 133
§ 12. Appoggio a cerniera 135

Capitolo VI. — **Travi a traliccio.**

§ 1. Generalità sul traliccio 138
§ 2. Forma delle travi a traliccio 140
1. Capriata tedesca. 142
2. Capriata inglese. ivi
3. Capriata francese (sistema Polonceau) . . ivi
§ 3. Generalità sul calcolo delle travi a traliccio . . 143

Pag.

§ 4. Determinazione dei carichi e delle pressioni negli appoggi (forze esterne) 145
§ 5. Determinazione delle tensioni delle sbarre (forze interne) 147
a) Metodo dei momenti (Metodo di Ritter). . ivi
b) Metodo del diagramma delle forze (metodo di Cremona) 148
§ 6. Regole speciali per le travi dei solai 151
1. Trave rettilinea a triangoli equilateri . . . ivi
a) Tensioni nelle briglie ivi
b) Tensione del traliccio 152
2. Travi rettilinee a triangoli equilateri . . . 154
a) Tensioni nelle briglie ivi
b) Tensione del traliccio 155
§ 7. Regole speciali per le travi delle tettoie . . . 156
§ 8. Determinazione della sezione delle sbarre. . . ivi
§ 9. Forma e collegamento delle sbarre del traliccio . 159
a) Sbarre perimetrali che lavorano alla trazione. ivi
b) Sbarre perimetrali che lavorano alla compressione 160
c) Sbarre del reticolato che lavorano alla trazione. 161
d) Sbarre del reticolato che lavorano alla compressione ivi
e) Piastre di attacco ivi
f) Chiodatura 162
§ 10. Appoggio oscillante e a rulli. ivi
a) Appoggio oscillante. ivi
b) Appoggio con rulli 163
§ 11. Esempi numerici per il calcolo statico delle travi a traliccio. 165
Calcolo della trave a traliccio. ivi
a) Ipotesi di carico. ivi
b) Determinazione delle pressioni d'appoggio . 166
c) Sforzi nelle sbarre perimetrali 167
d) Sforzi nel reticolato ivi
e) Determinazione delle sezioni 169
Capriata francese 170
a) Carichi ivi
b) Tensioni delle sbarre 171
c) Determinazione delle sezioni 172
Capriata inglese 174
a) Carichi ivi
b) Tensioni delle sbarre ivi

Capitolo VII. — **Travi ad arco.**

§ 1. Concetto di una trave ad arco 176
§ 2. Classificazione e forma delle travi ad arco . . 178
§ 3. Calcolo dell'arco a tre cerniere 179
a) Determinazione della spinta nel caso di carichi verticali. ivi
b) Determinazione della spinta nel caso di carichi obliqui 182
c) Sollecitazione della sezione dell'arco. . . 183
d) Carico più sfavorevole 185
§ 4. Calcolo dell'arco a due cerniere. 186
a) Determinazione della spinta nel caso di carichi verticali. ivi

Pag.

b) Determinazione della spinta nel caso dei carichi obliqui 188
c) Sollecitazione della sezione dell'arco . . 189
d) Carico più sfavorevole ivi
§ 5. Calcolo semplificato dell'arco a tre cerniere nel caso di carico uniformemente ripartito . . ivi
§ 6. Calcolo dell'arco a traliccio a tre cerniere. . . 192
§ 7. Forme delle singole parti di una trave ad arco . 194
§ 8. Appoggi e cerniere nelle travi ad arco . . . 195
1. Cerniere alle imposte ivi
2. Cerniera al vertice 197

CAPITOLO VIII. — **Solai.**

§ 1. Uso del ferro nei solai 198
§ 2. Solai in legno con sottotravi in ferro ivi
§ 3. Solai con travi in ferro e riempimento in legno . 200
§ 4. Solai con travi in ferro e voltine in mattoni o calcestruzzo 203
Materiale e costruzione. ivi
§ 5. Calcolo dei solai con voltine. 206
Spessore delle volte. ivi
Concatenamento dei campi mediani. . . . 207
Ancoraggio dei campi estremi 210
§ 6. Solai con travi in ferro e lastre piane artificiali. 214
1. Lastre di mattoni e strisce di ferro. . . 215
2. Lastre di calcestruzzo e ferro. 218
3. Lastre piane senza ferro 221
§ 7. Solai con lastre in ferro 224
1. Solai con lamiera ondulata 225
2. Lamiera curva 227
3. Ferri speciali per copertura di solai . . 228

CAPITOLO IX. — **Pareti, balconi coperti, scalinate.**

§ 1. Appoggi di muri su travi in ferro 229
§ 2. Pareti a traliccio 232
a) Per muratura in mattoni 235
b) Per rivestimento con lamiera ondulata o piana ivi
c) Per rivestimenti a vetro ivi
§ 3. Sostegni delle parti sporgenti 238
§ 4. Scale massicce 242
§ 5. Calcolo delle travi 244
a) Calcolo delle travi del pianerottolo nel caso di scalini liberi ivi
b) Calcolo delle travi per rampanti e pianerottoli nel caso di scalini sostenuti inferiormente 245
α) Trave del rampante ivi
β) Travi del pianerottolo 246
γ) Travi laterali continue 247
c) Calcolo delle travi del pianerottolo nelle scale con archi rampanti ivi
§ 6. Scale in ferro 250
a) Gradini ivi
b) Appoggi degli scalini 251
c) Travi laterali e travi dei pianerottoli . . ivi
d) Scale a chiocciola 252

Pag.

§ 7. Descrizione e calcolo statico della scala rappresentata nella tav. 52. 253
1. Gradini 254
2. Travi laterali. ivi
3. Trave principale del pianerottolo. . . . 256
4. Travi del pianerottolo di angolo 259

CAPITOLO X. — **Coperture in vetro (Lucernari).**

§ 1. Disposizione generale dei lucernari 261
§ 2. Lastre di vetro. 263
§ 3. Ferri di appoggio delle lastre 265
§ 4. Attacco delle lastre al ferro. Tenuta delle commessure 268
1. Materiale per le giunzioni. ivi
2. Disposizione delle commessure longitudinali fra lastre e ferri. 269
3. Disposizione e giuntura delle commessure trasversali. 270
§ 5. Copertura del comignolo e dei displuvi . . . 272
§ 6. Grondaie e impluvi 274
§ 7. Attacco dei tetti a vetro alle altre parti di costruzione. Protezione del comignolo e disposizione relative 277
§ 8. Calcolo dei lucernari a padiglione 278
1. Tensioni del traliccio 282
2. Tensioni di flessione 283
3. Determinazione della sezione ivi
a) Comignolo ivi
b) Displuvi ivi

CAPITOLO XI. — **Coperture metalliche — Grondaie.**

§ 1. Generalità sulle diverse specie di coperture metalliche. 284
§ 2. Coperture con lamiere piane. 286
a) Lamiera di zinco ivi
b) Lamiera di ferro 287
c) Lamiera di rame 288
d) Lamiera di piombo. ivi
§ 3. Copertura con lamiera ondulata di zinco . . . 288
Calcolo della distanza fra gli arcarecci. . . ivi
Attacco della lamiera ondulata agli arcarecci. 289
§ 4. Lamiera ondulata di ferro. 290
Calcolo della distanza fra gli arcarecci. . . 291
Attacco della lamiera ondulata agli arcarecci. ivi
Rimozione dell'acqua di condensazione. . . 293
§ 5. Lamiere ondulate in ferro. Copertura del comignolo, displuvi, impluvi, gronde e loro attacco alle altre parti della costruzione . . 294
§ 6. Canali per tetti — Disposizione generale . . . 296
§ 7. Canali per tetti — Dettagli 298

CAPITOLO XII. — **Tetti a capriata.**

§ 1. Generalità 301
§ 2. Travicelli. 303
§ 3. Arcarecci. 306
§ 4. Calcolo degli arcarecci. 309
§ 5. Capriate dei tetti a travata 316

Pag.
§ 6. Capriate dei tetti ad arco 320
§ 7. Tetti liberi di lamiera ondulata 324
§ 8. Capriate per pensiline 327
§ 9. Controventatura 331
§ 10. Tetti a capriata a più campate 336
§ 11. Capriate per impluvi e displuvi 338
§ 12. Capriata per tetti a padiglione e a cupola. . . . 341
§ 13. Illustrazione delle capriate in ferro disegnate nelle tavole 345

Capitolo XIII. — **Tetti ad armatura reticolare.**

§ 1. Generalità 355
§ 2. Il traliccio gobbo 359
§ 3. Trasformazione dei sistemi di sbarre 363
§ 4. Determinazione degli sforzi nelle sbarre 368
§ 5. Tralicci a cupola 371
§ 6. Tralicci a botte 376
§ 7. Calcolo semplificato dei tetti piani a cupola e a padiglione 379
a) Ipotesi di carico ivi
b) Sforzi nei puntoni 380
c) Sforzi negli anelli 381
d) Sforzi nelle diagonal 382
e) Esempi numerici ivi
§ 8. Calcolo semplificato pei tetti ripidi a torre . . . 384
a) Ipotesi di carico ivi
b) Stabilità della cupola della torre rispetto alla pressione del vento 385
c) Determinazione degli sforzi nelle sbarre . . ivi
d) Cupola di una torre quadrangolare 386
§ 9. Regole costruttive pei tetti a sesto ribassato a padiglione ed a cupola 390
a) Copertura del circo 396
b) Tetto a cupola 397
c) Parete a traliccio e colonne 398
§ 10. Costruzione dei tetti di torre a sesto molto acuto 399
§ 11. Torrette di colmo 401
§ 12. Tetti ad armatura reticolare su piante quadrate e simili. 407

Capitolo XIV. — **Stecconate.**

§ 1. 415
§ 2. Finestre 416
a) Finestre in ghisa 417
b) Finestre in ferro ivi
§ 3. Porte e portoni 418
§ 4. Vetrine 420
§ 5. Supporti delle campane 422

Appendici (Ing. Rossi).

I. Travature iperstatiche — Esempi diversi. . . . 425
Studio di una tettoia con capriate in ferro del tipo Potauceau. 436
II. Il cemento armato nelle costruzioni civili.
Cap. I Generalità 440
Cap. II Principi della teoria statica 445
Cap. III. Applicazioni 450
1) Solettone di fondazione su terreno cedevole ivi
2) Salettone di fondazione di un pilastro fortemente caricato 451
3) Pilastro sorreggente carichi notevoli . . . ivi
4) Solaio composto di soletta con nervature . 452
5) Solaio per ricoprire un locale di abitazione civile 453
III. Cenni sulla ellisse di elasticità.
Generalità 456
Teoremi generali ivi
1) Teorema di reciprocità (Betti) ivi
2) Teorema (somma delle rotazioni) 457
Generazione delle elissi 458
Esempi di Travi a parete piena e reticolare. . . 459
IV. Brevi cenni sugli strumenti di misura delle deformazioni nelle costruzioni 463
1) Biffini ivi
2) Crushes 464
3) Flessimetri a rotazione ivi
4) » a filo teso. ivi
5) Estensimetro a combinazione di leve. . . . ivi
6) Registratori delle oscillazioni od oscillografi . 465
V. Protezione delle costruzioni in ferro contro gli incendi 466
Nota sulle forze interne e comportamento elastico resistente del materiale ivi
Nota aggiuntiva al paragrafo della pressoflessione 468
Tabelle . . . . . 1 a 40

Collegamenti a vite

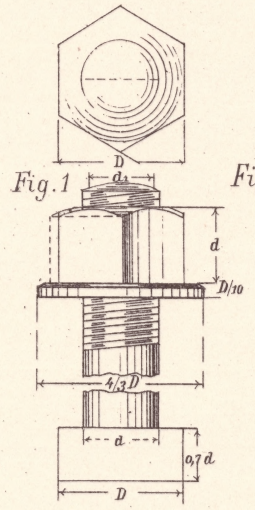


Fig. 1

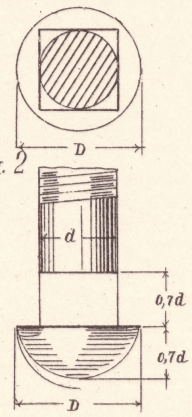


Fig. 2

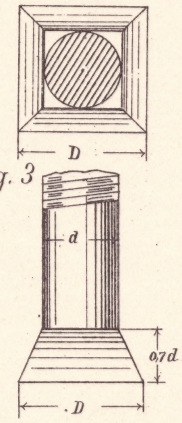


Fig. 3

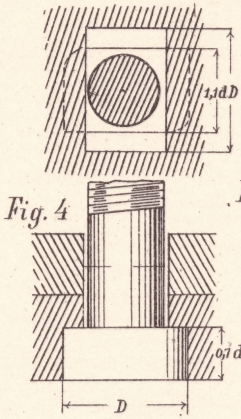


Fig. 4

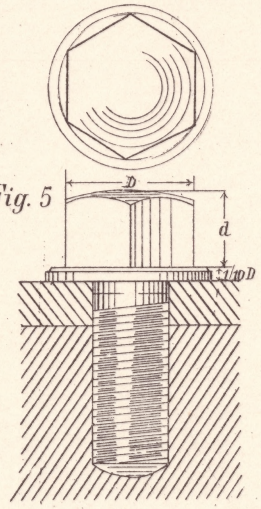


Fig. 5

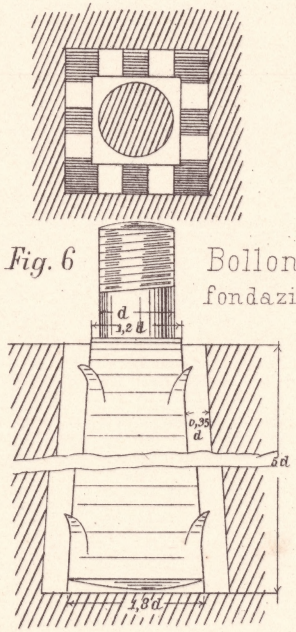


Fig. 6 Bollone di fondazione

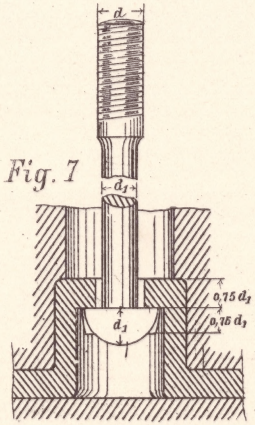


Fig. 7

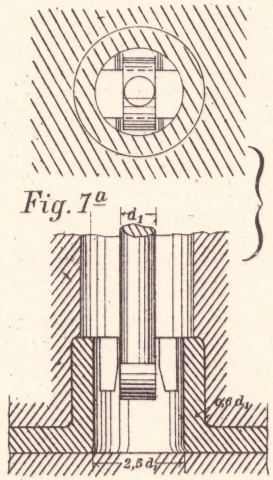


Fig. 7ª

Catena di fondazione

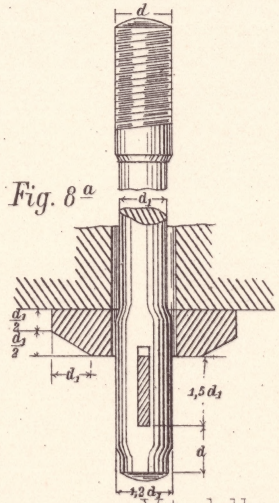


Fig. 8ª

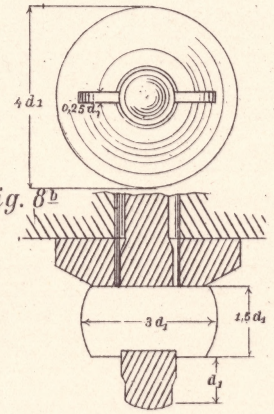


Fig. 8ᵇ

Vite della catena

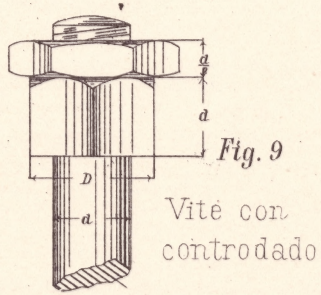


Fig. 9 Vite con controdado

Stabilimenti Riuniti d'Arti Grafiche MILANO

Collegamento a vite

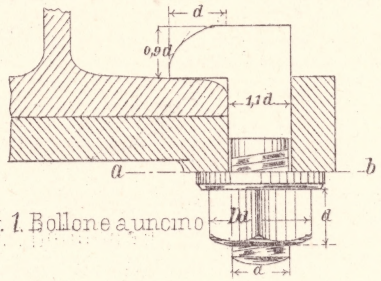


Fig. 1. Bollone a uncino

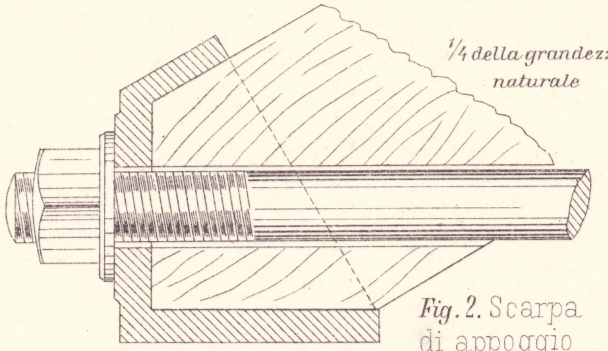


Fig. 2. Scarpa di appoggio

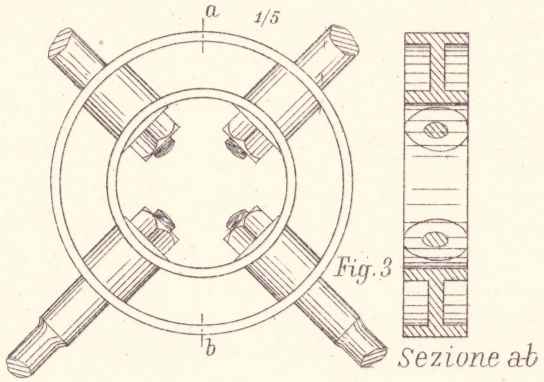
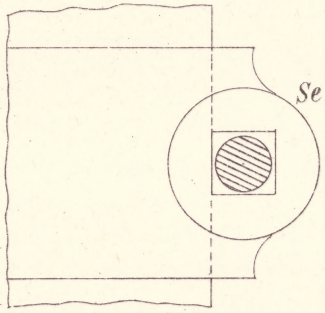


Fig. 3

Sezione a-b



Sezione a-b

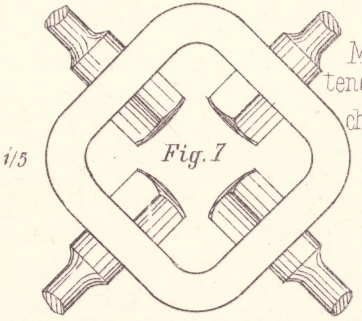


Fig. 7

Manicotto tenditore per tiranti che si incrociano

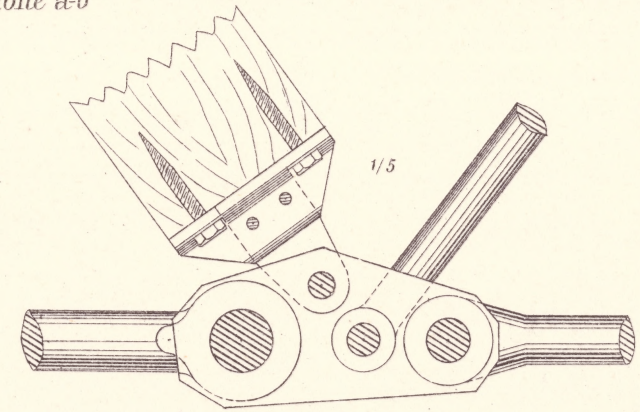
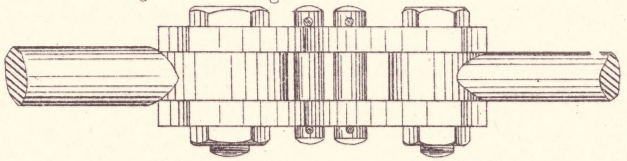


Fig. 5 Collegamento a vite



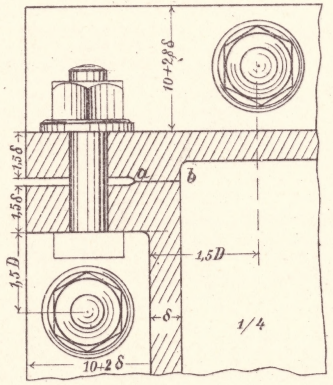


Fig. 4 Collegameto a briglia

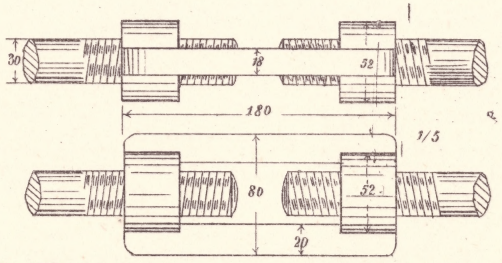
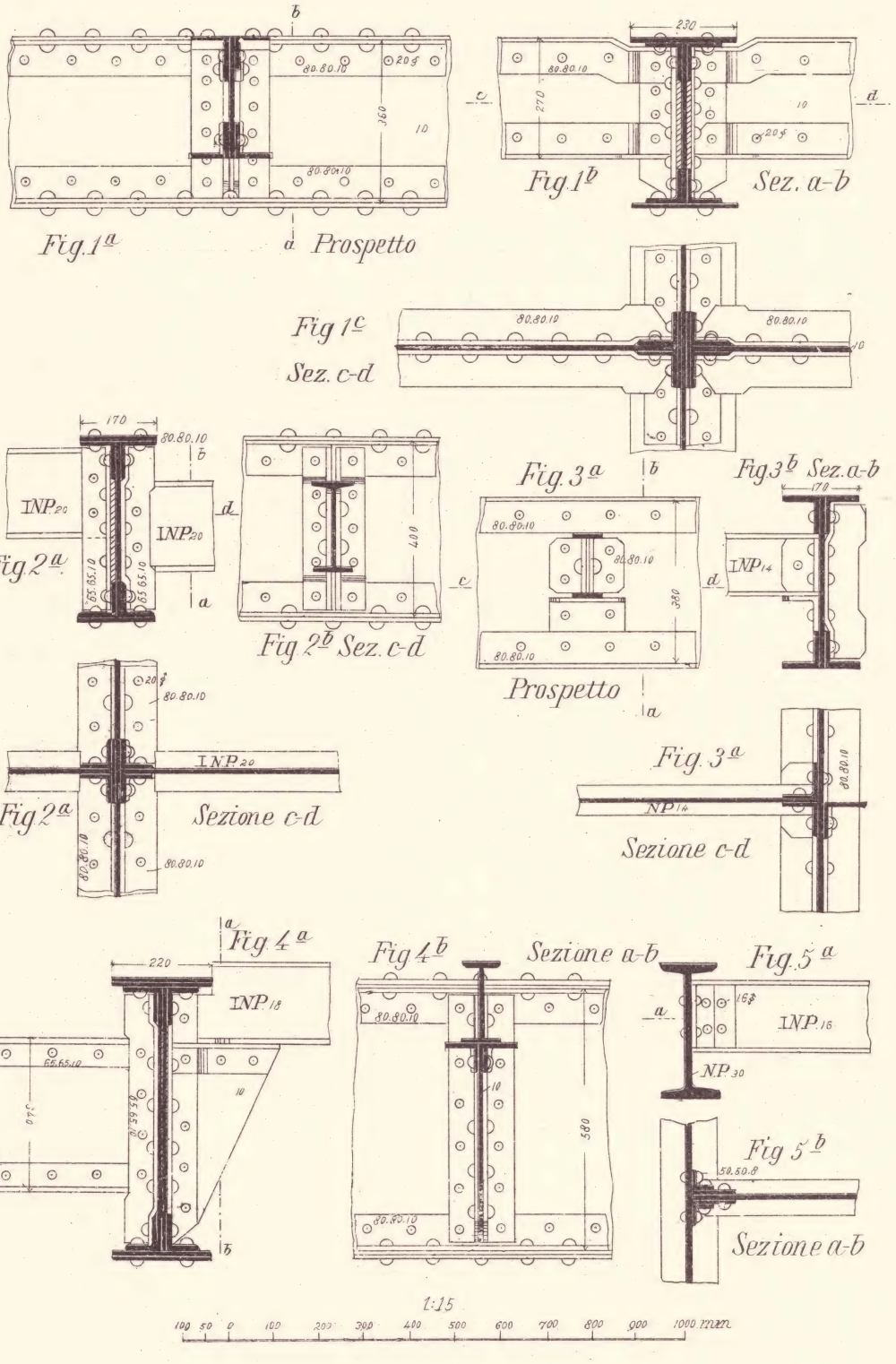


Fig. 6 Manicotto tenditore per tiranti rettilinei

Bregmann III

Stabilimenti Riuniti d'Arti Grafiche - MILANO

Attacco delle travi



Stabilimenti Riuniti d'Arti Grafiche - MILANO

Colonne in ghisa

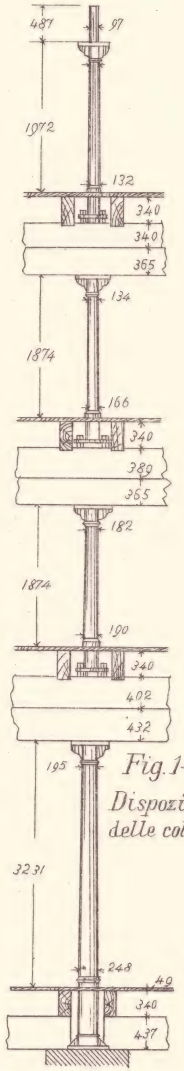


Fig.1ª 1:100
Dispozizione delle colonne

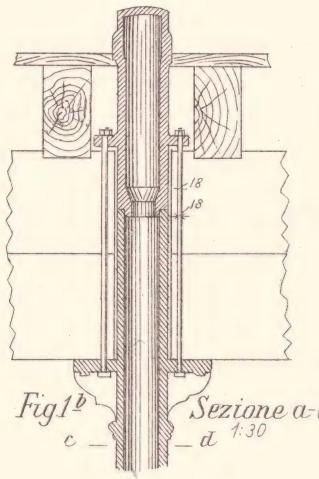


Fig.1ᵇ Sezione a-b 1:30

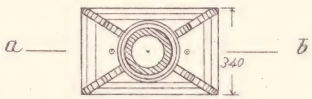
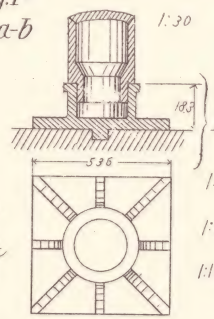


Fig.1ᶜ Sezione c-d

Fig.1ᵈ Sez. a-b 1:30



Piede della colonna

Fig.1ᵉ Vista di sopra 1:30

Fig.1 Punto franco di Harburg

Fig.2ª Testa della colonna

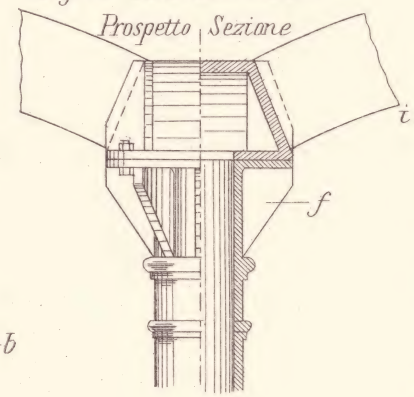


Fig.2ᵇ

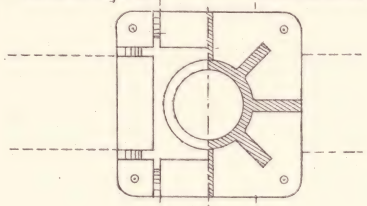


Fig.2 Testa della colonna sup.ᵗᵉ all'imposta dell'arco

1:30 50 40 30 20 10 5 0 50 100 cm

1:20 0 5 10 20 30 40 50 60 70 80 90 100 cm

1:100 0 0.5 1 2 3 4 5 m

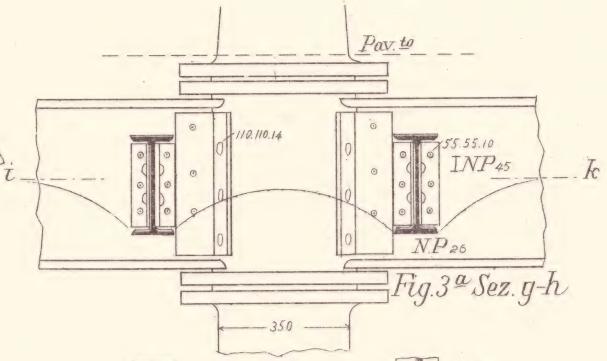


Fig.3ª Sez. g-h

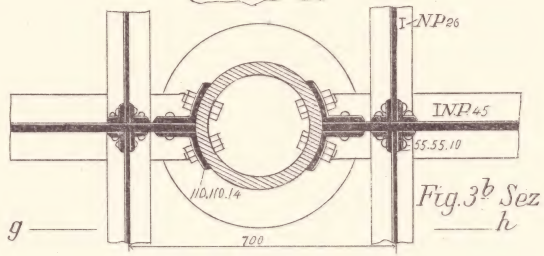


Fig.3ᵇ Sez i-k

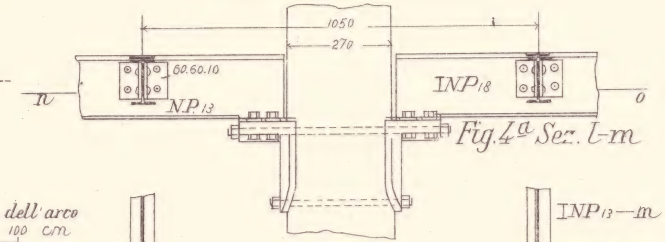


Fig.4ª Sez. l-m

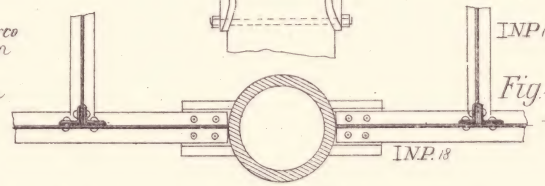


Fig.4ᵇ Sez. n-o

Fig.3 e 4 Colonne della biblioteca dell'Università di Halle sulla Saale

Bergmann III

Stabilimenti Riuniti d'Arti Grafiche MILANO

Sostegni e travi

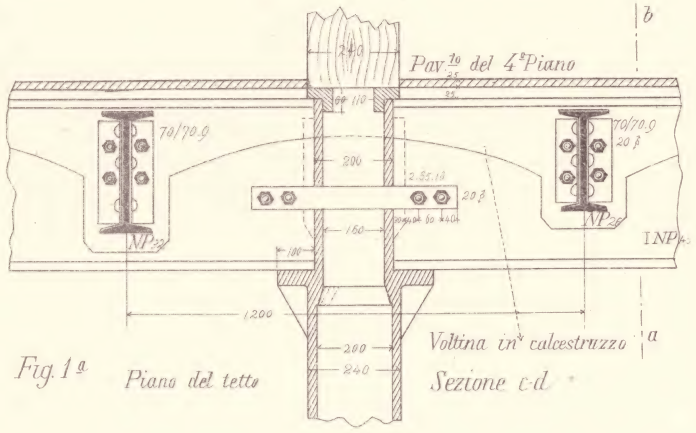


Fig. 1ª Piano del tetto

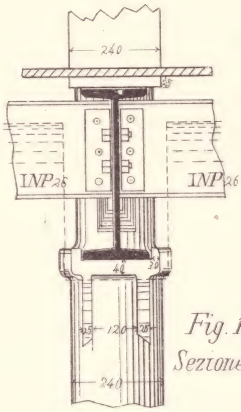


Fig. 1b Sezione a-b

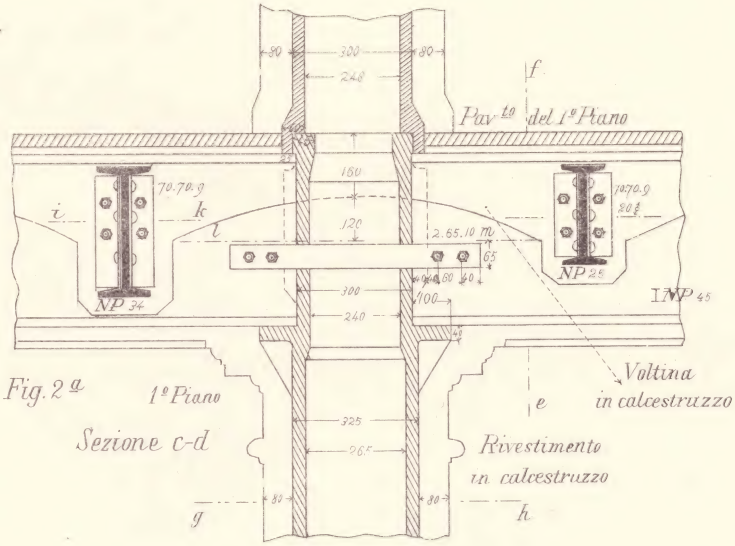


Fig. 2ª 1° Piano Sezione c-d

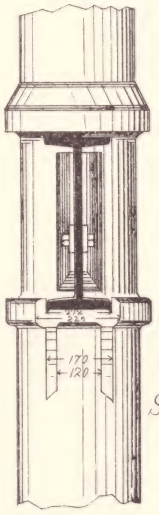
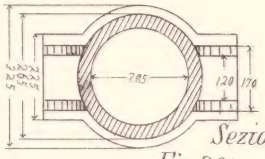


Fig. 2b Sezione ef



Sezione g-h

Fig. 2c (vista di sotto)

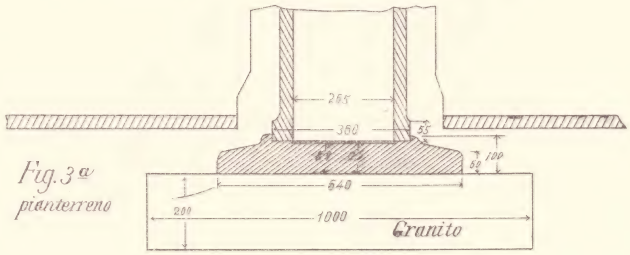


Fig. 3ª pianterreno

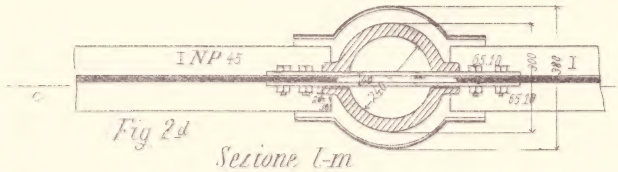


Fig. 2d Sezione l-m

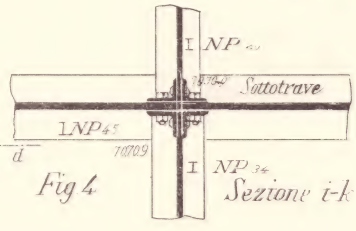


Fig. 4 Sezione i-k

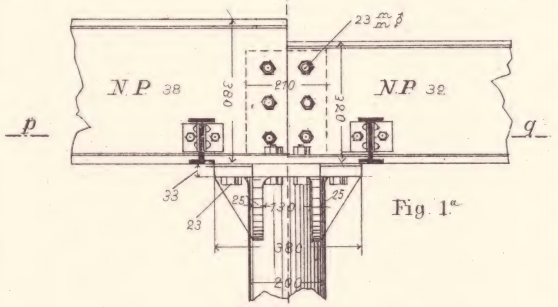
Scala 1:20

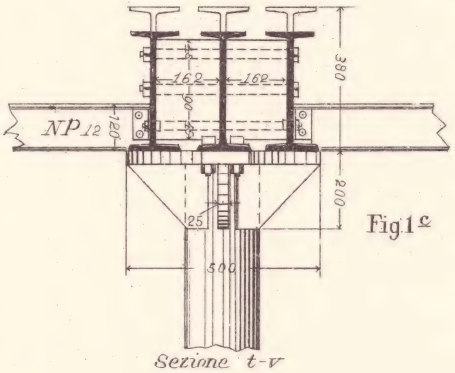
50 50 0 100 200 300 400 500 600 700 800 900 1000 m/m

Magazzino di deposito nella Kaiserstrasse a Berlino

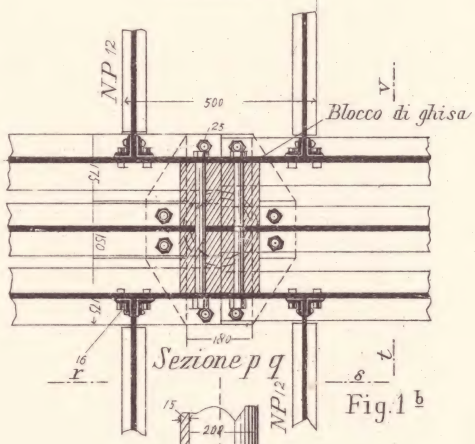
Stabilimenti Riuniti d'Arti Grafiche - MILANO

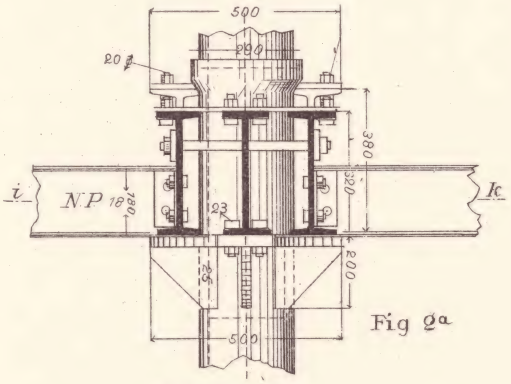
Sostegni a travi



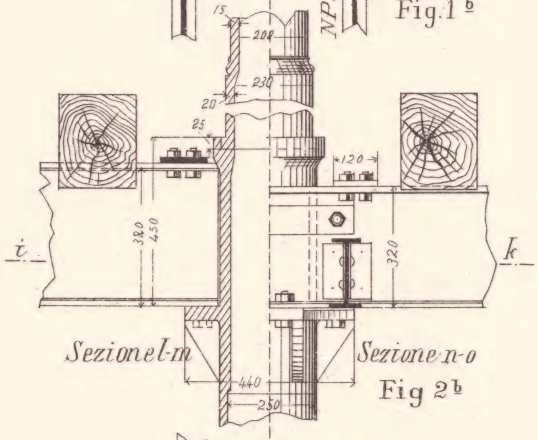


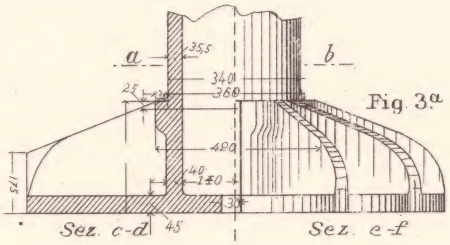
Sezione t-v

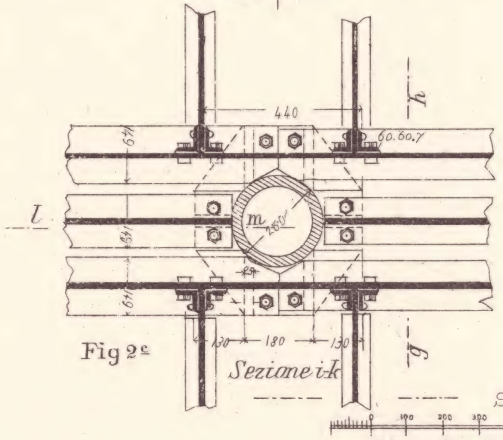


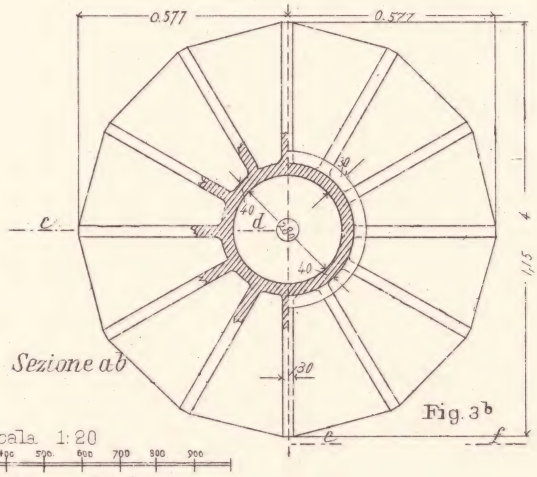


Sezione g.h







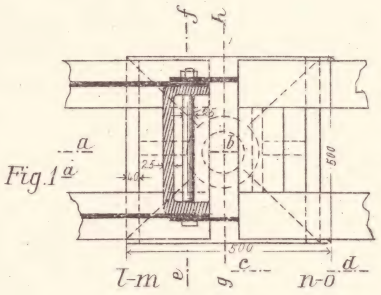


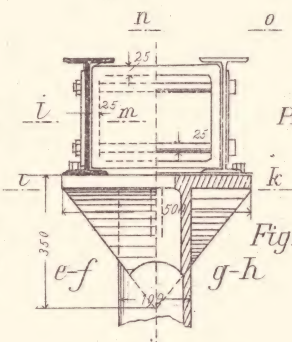
Scala 1:20

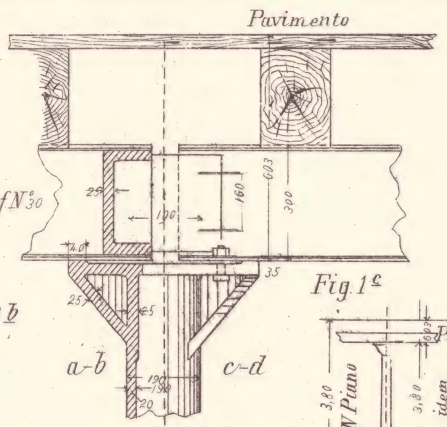
Mercato Werder a Berlino

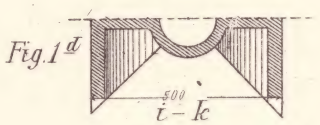
Stabilimenti Riuniti d'Arti Grafiche-MILANO

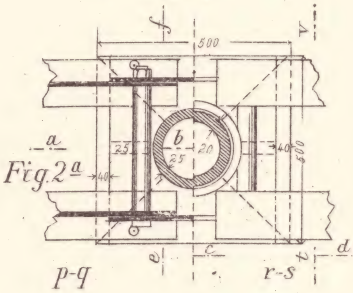
Sostegni e travi

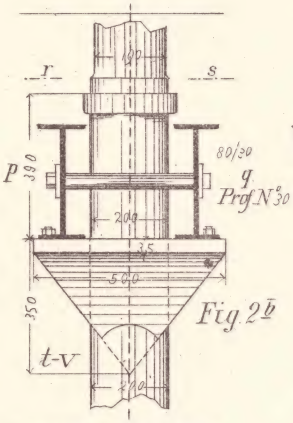


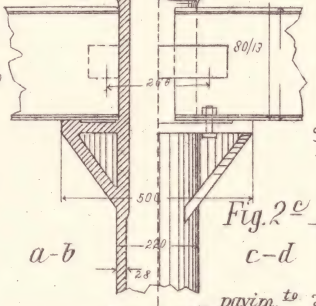


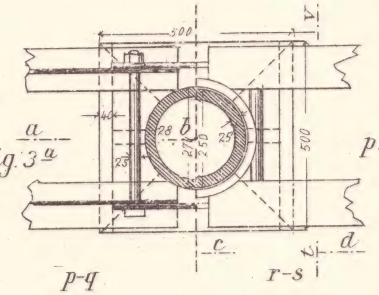


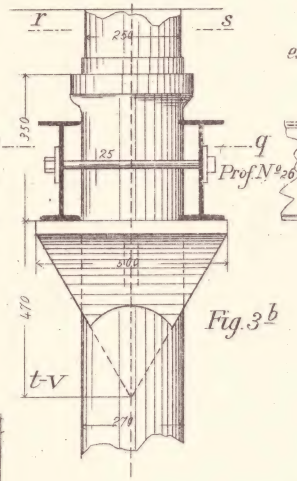


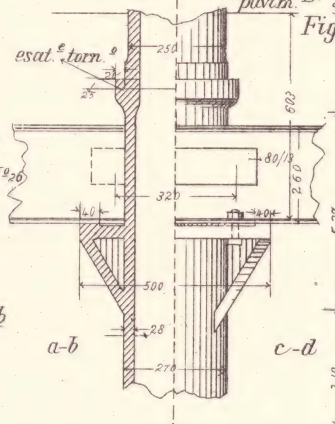


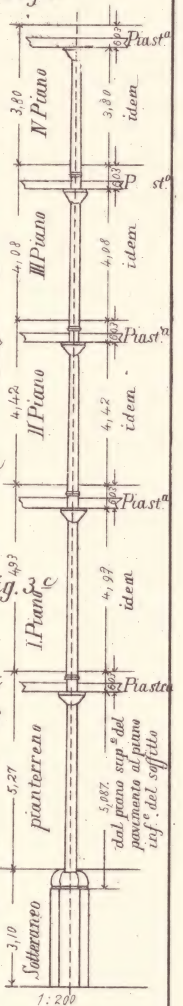


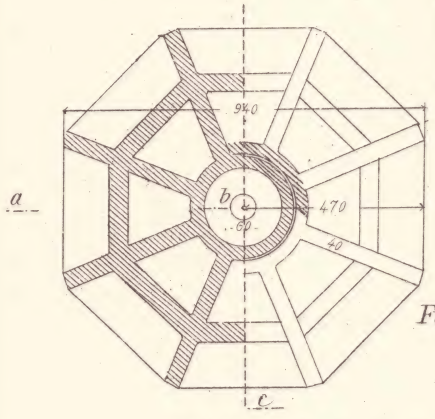


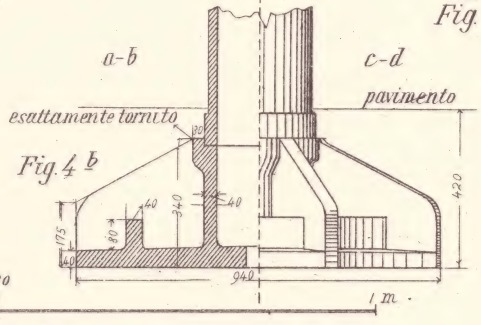










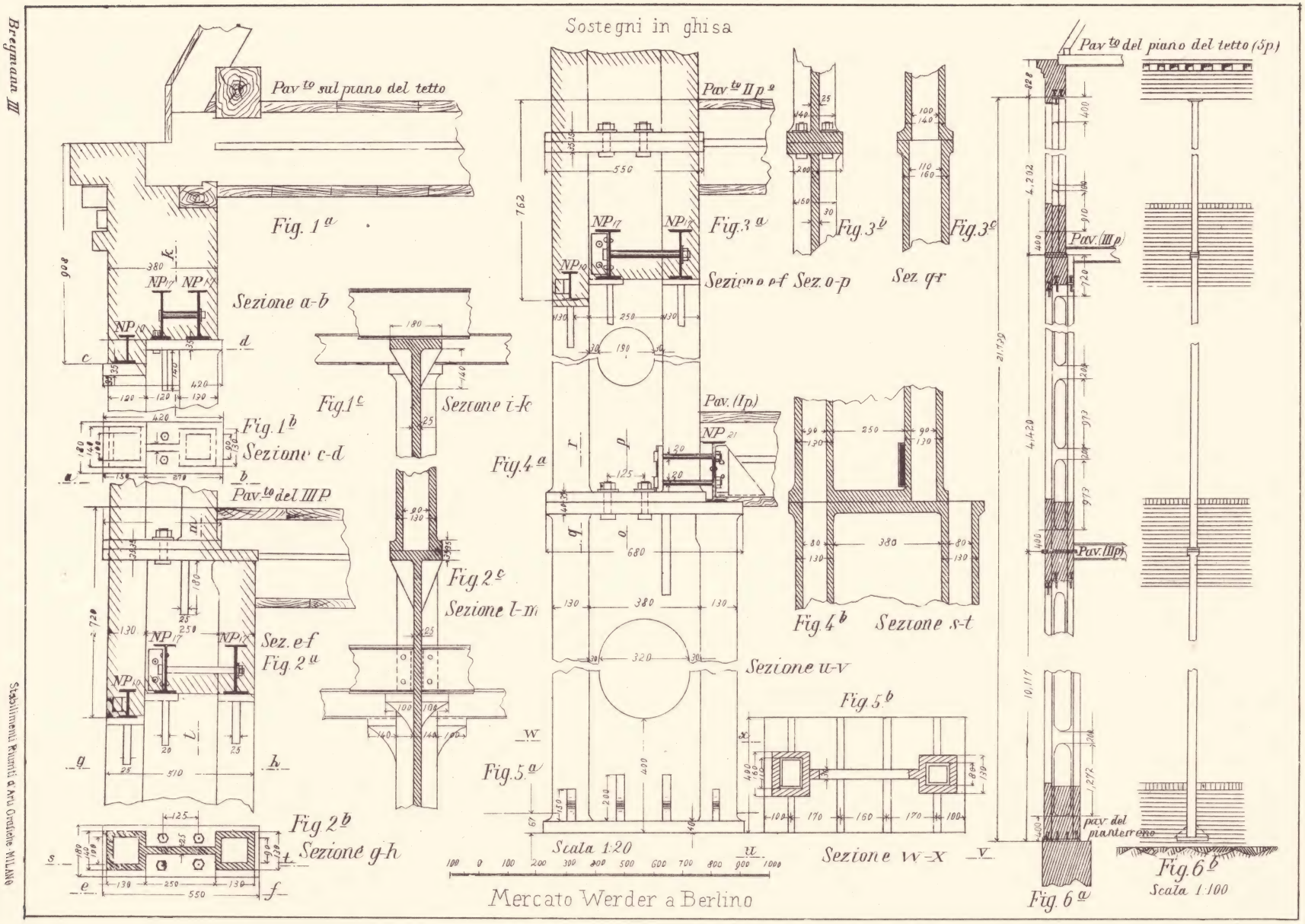


M 1 20

0 50 100 90 80 70 60 50 40 30 20 10 0 1 m

Mercato Werder a Berlino

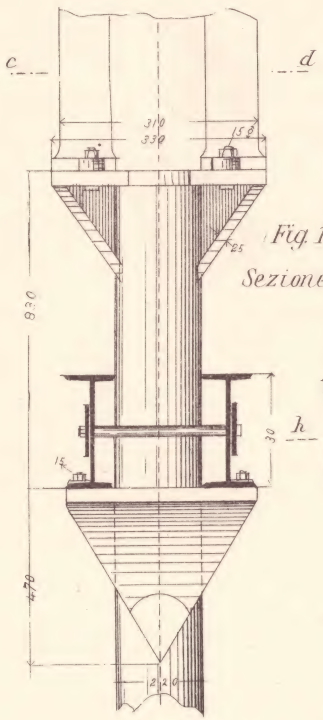
Stabilimenti Riuniti d'Arti Grafiche - MILANO

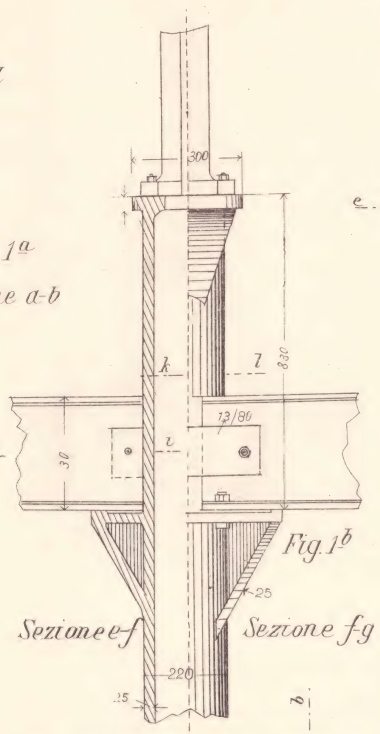


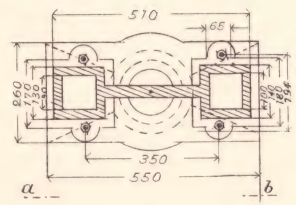
Tav. 8

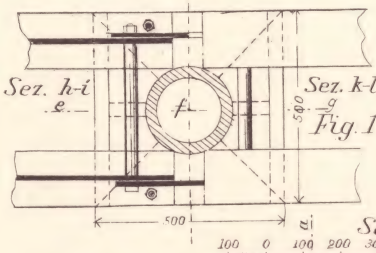
Stabilimenti Riuniti d'Arti Grafiche MILANO

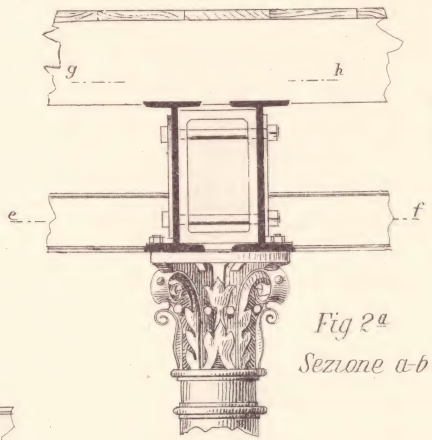
Sostegni e travi

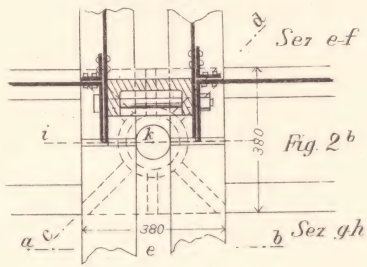


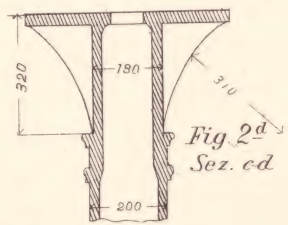


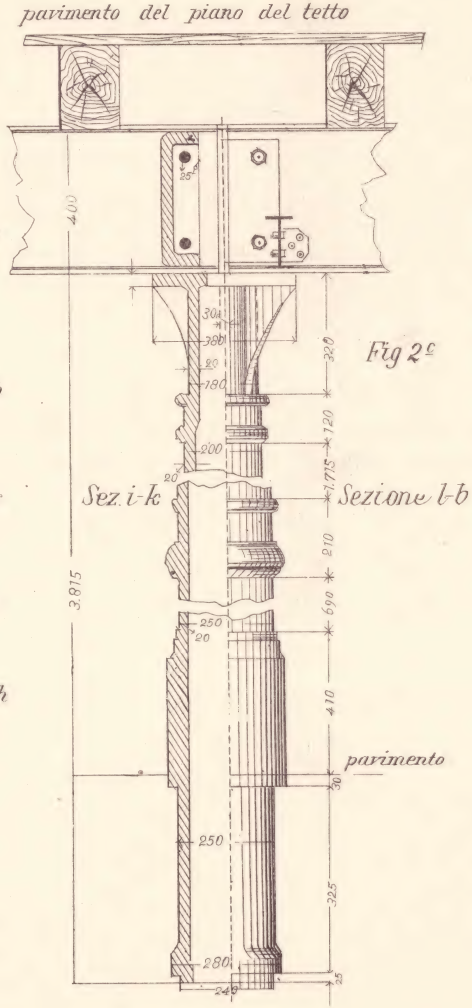












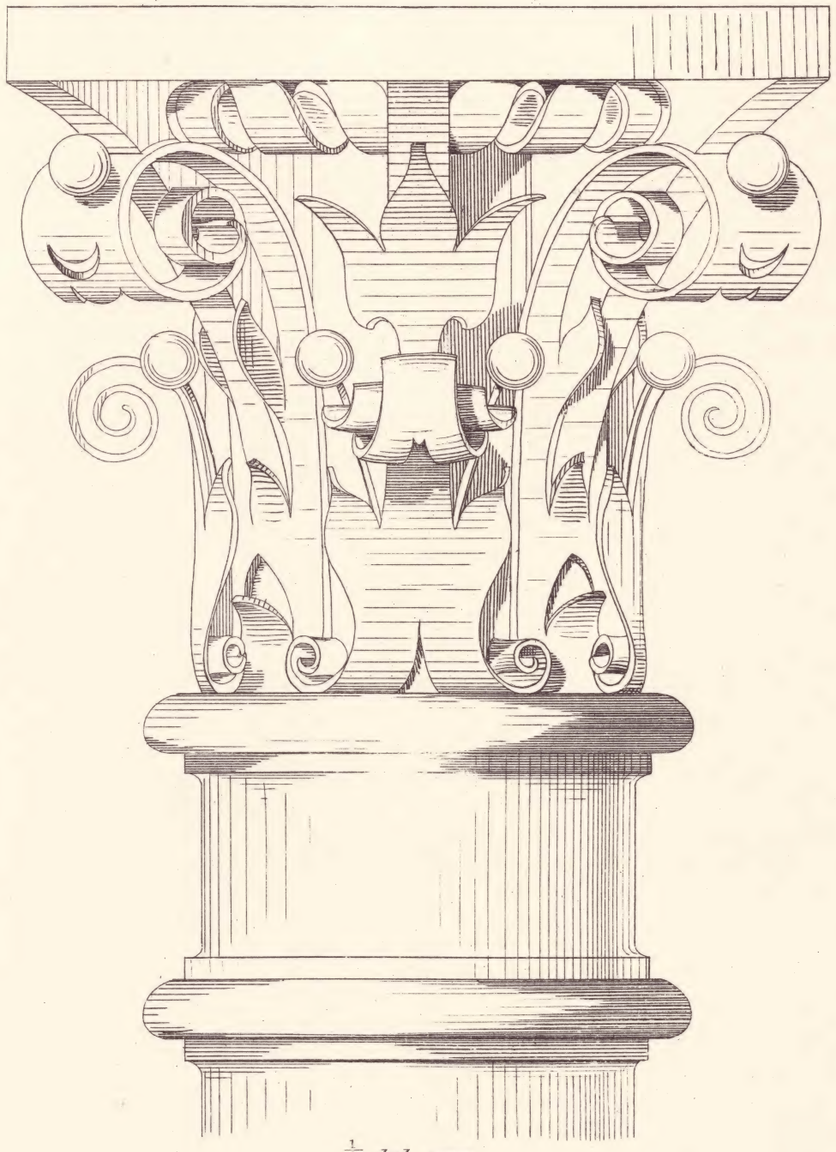
Scala 1:20

100 0 100 200 300 400 500 1 m.

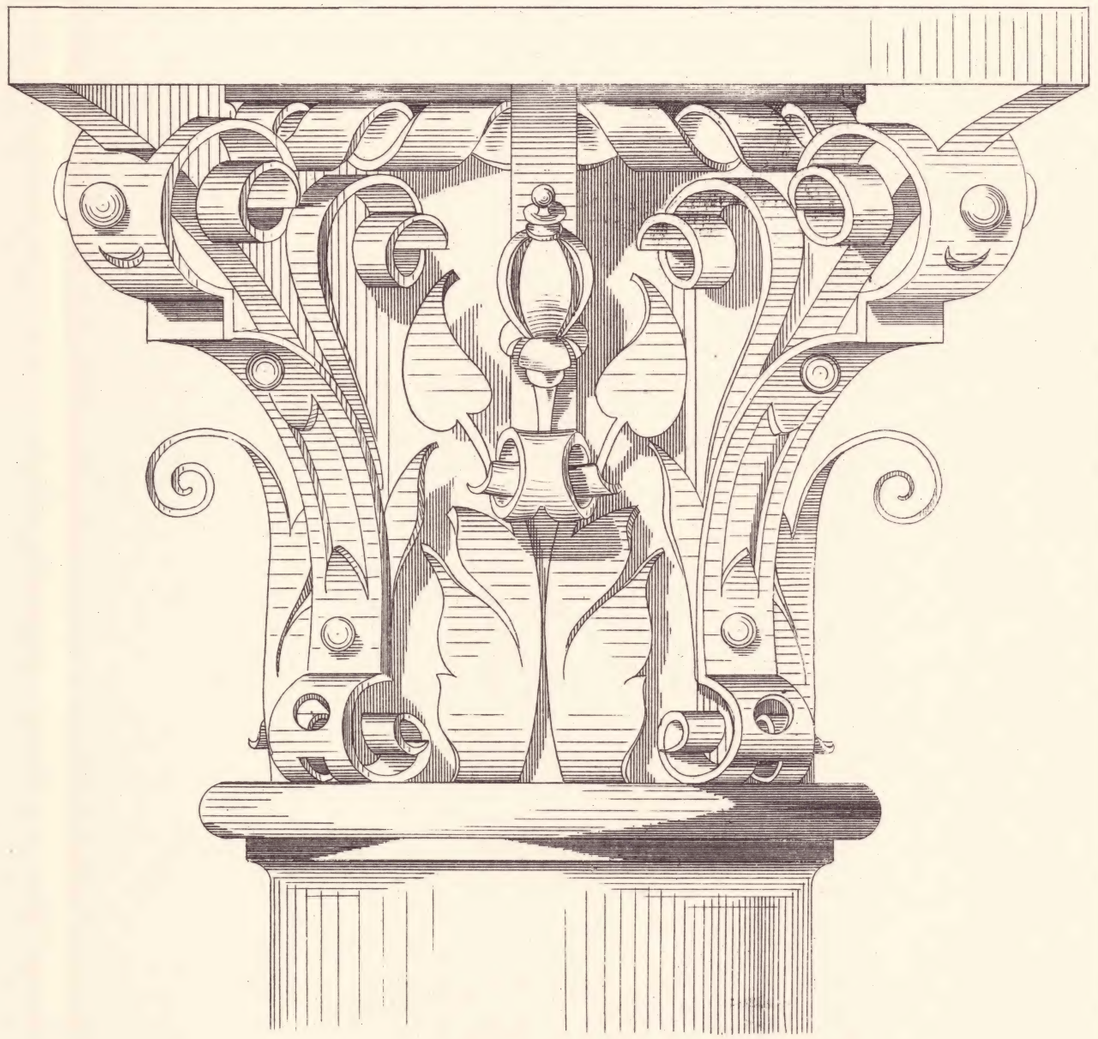
Mercato Werder a Berlino

Stabilimenti Riuniti d. Arti Grafiche - Milano

Capitelli di ferro forgiato su colonne di ghisa



$\frac{1}{3}$ *dal vero*



$\frac{1}{4}$ *dal vero*

Stabilimenti Riuniti d'Arti Grafiche - MILANO

Colonne dei ponti della Ferrovia Metropolitana di Berlino

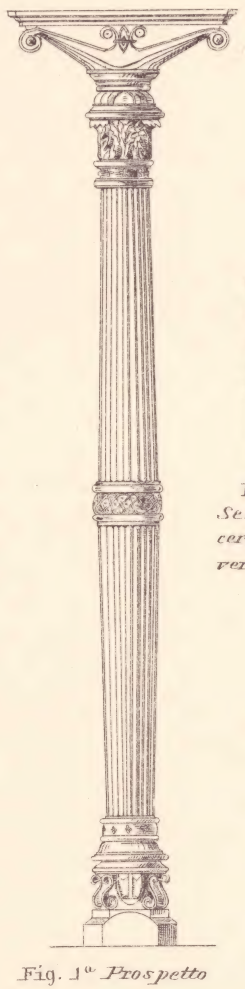


Fig. 1ª *Prospetto*

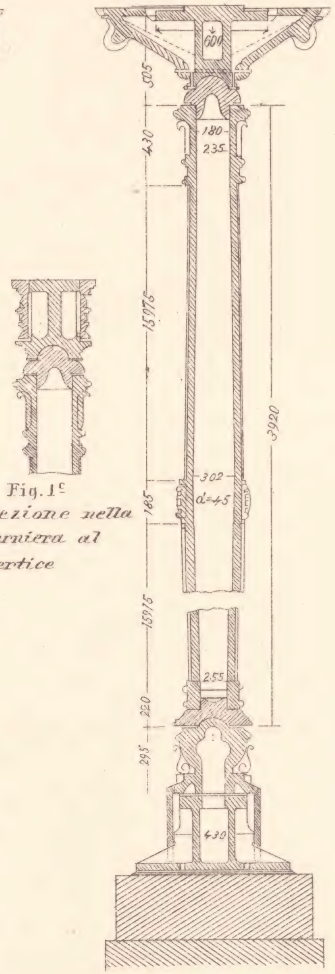


Fig. 1b *Sez. long.*

Fig. 1c
Sezione nella cerniera al vertice

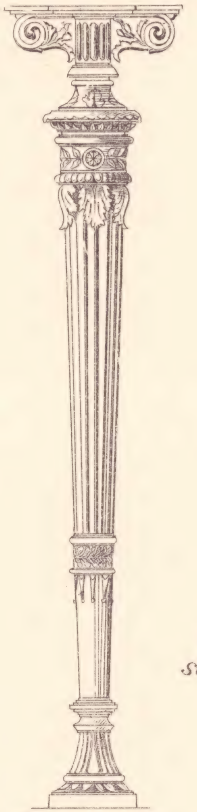


Fig. 2ª *Prospetto*

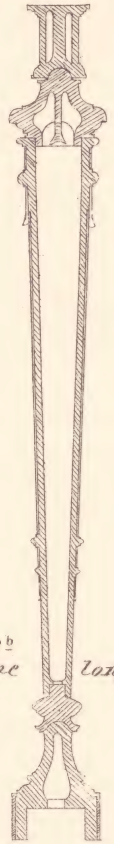


Fig. 2b
Sezione long.

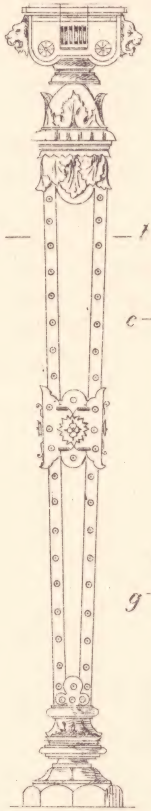


Fig. 3ª *Vista ant.*

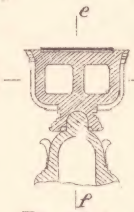
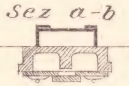


Fig. 3ª *Sez g-h*



Sez. c-d

Fig. 3ª

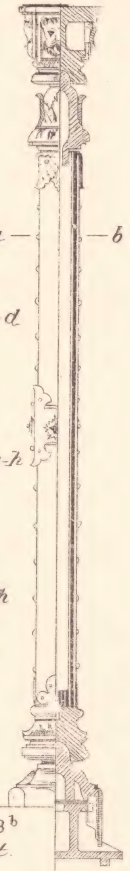


Fig. 3b
Vista lat.

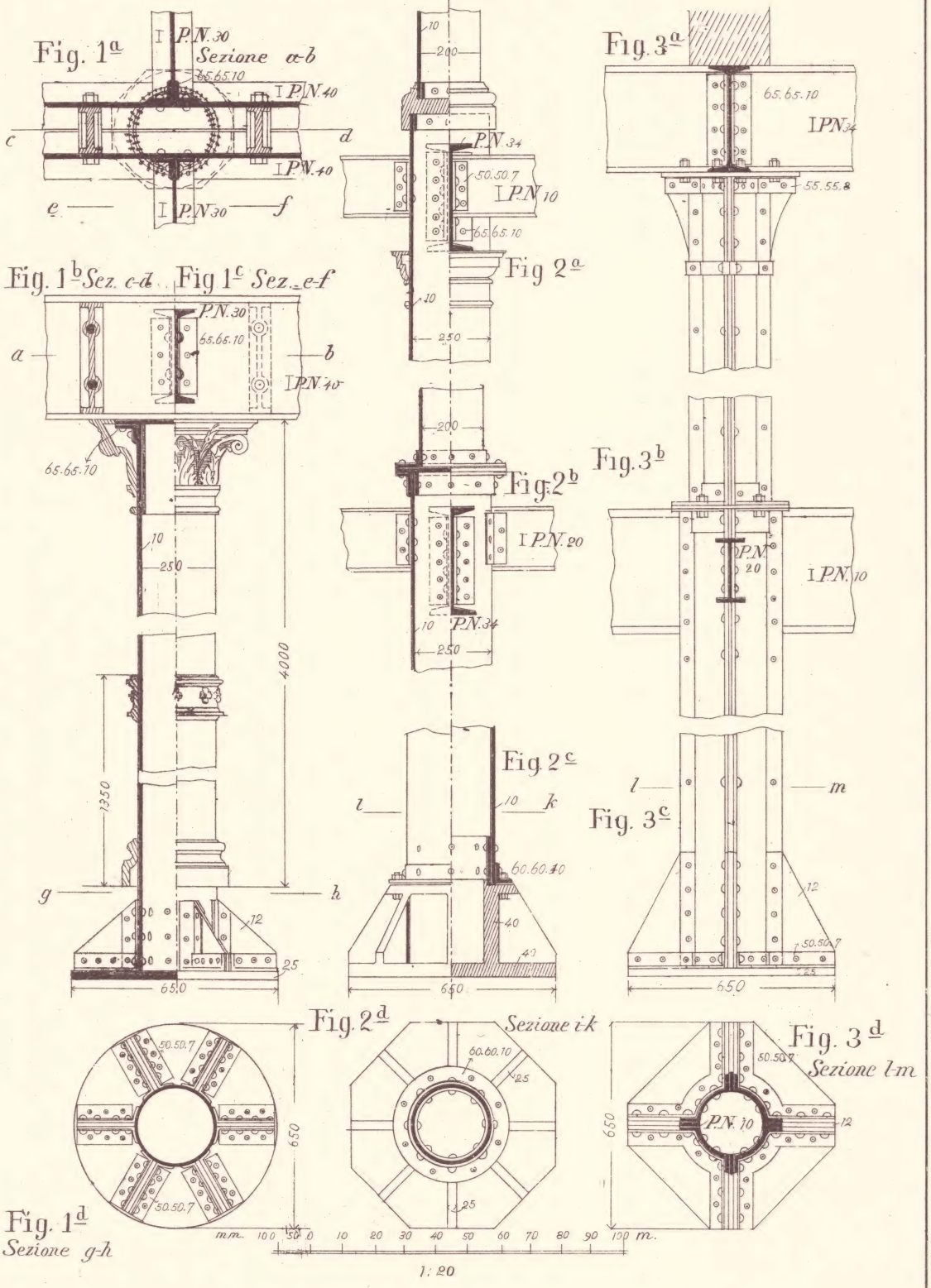
Scala 1:40

Fig. 3c *Sez. e-f*
(Fig 3d)

Fig. 1 e 2 *Colonna in ghisa con cerniere alla testa ed alla base*
Fig. 3 *Colonna con fusto in ferro e con testa e base di ghisa*

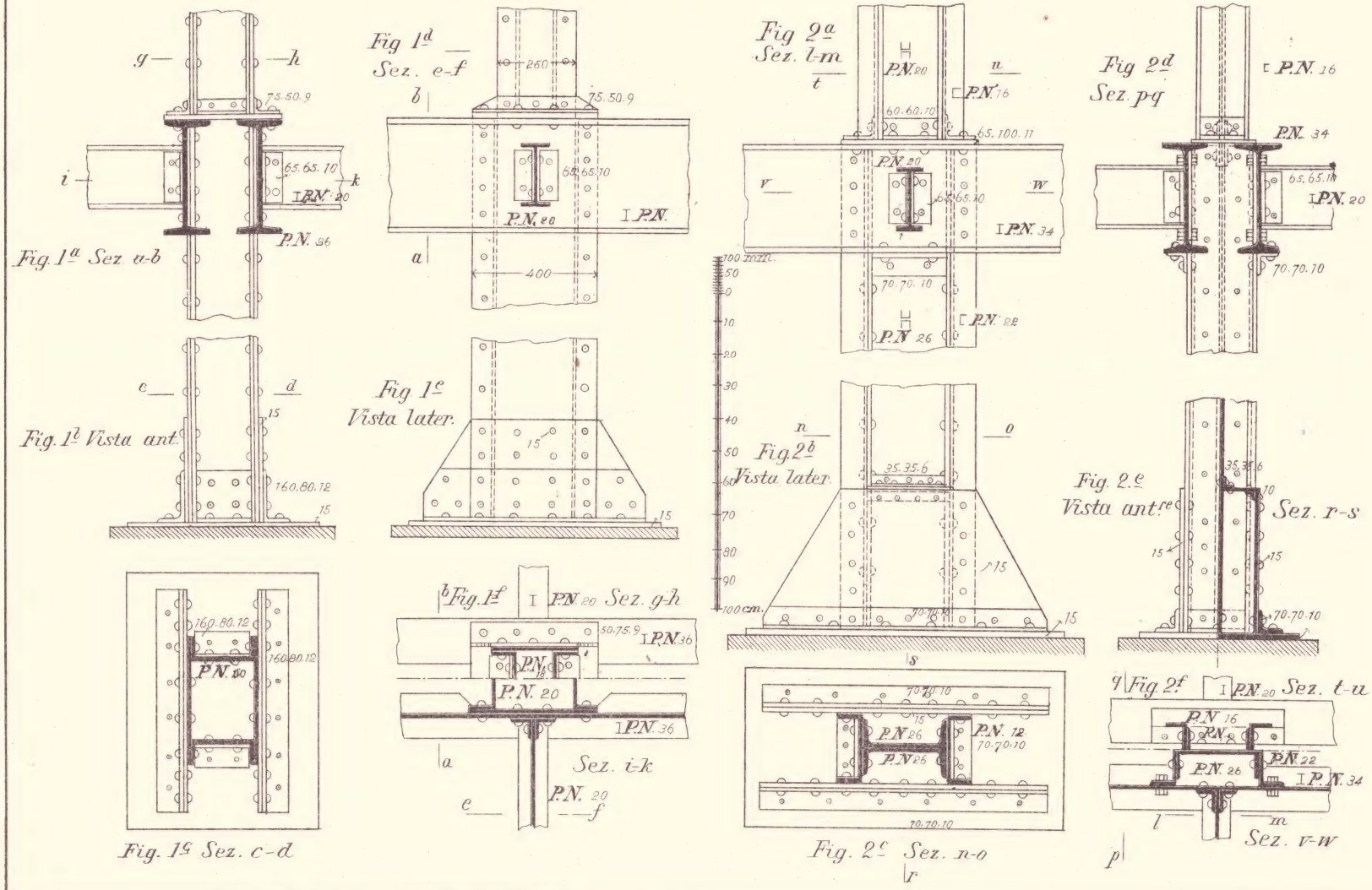
Stabilimenti Riuniti d'Arti Grafiche - Milano

Colonne in ferro



Stabilimenti Riuniti d. Arti Grafiche - MILANO

Sostegni in ferro



Stabilimenti Printiti di Arti Grafiche - MILANO

Pilastri in ferro

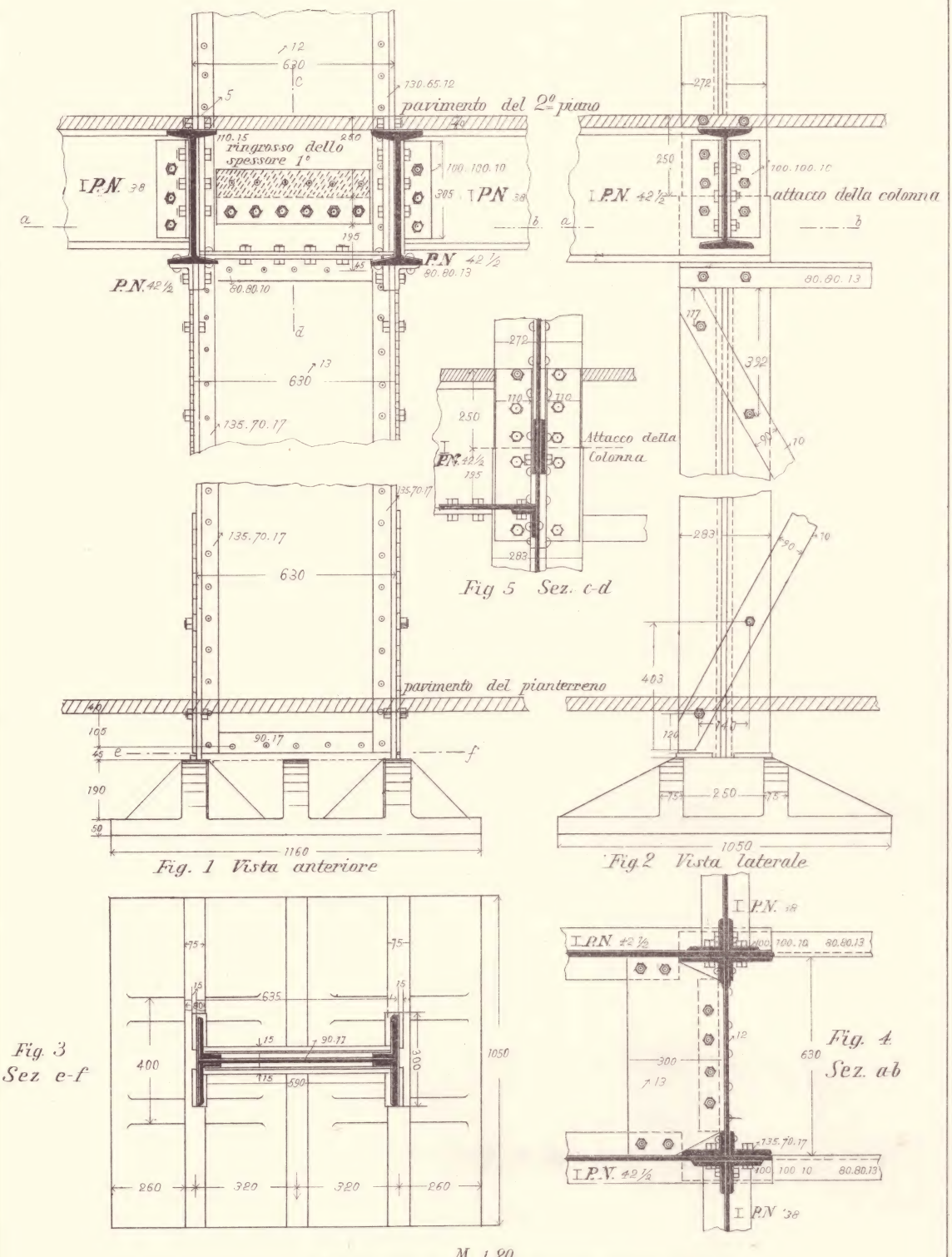


Fig 5 Sez. c-d

Fig. 1 Vista anteriore

Fig. 2 Vista laterale

Fig. 3 Sez e-f

Fig. 4 Sez. ab

Edifizio dell'Industria nella Beuthstrasse a Berlino

Stabilimenti Riuniti d'Arti Grafiche - MILANO

Tetto dell'edifizio dell'Industria nella Beuthstrasse di Berlino

Scala 1:20

100 50 0 100 200 300 400 500 1000 mm.

Sc. 1:40

100 0 100 200 300 400 500 1000 1500 2000 mm.

Fig. 4 *Sez. c-d* (verso sinistra) — ringrosso

100.100.16

Fig 5 *Sez a-b* (verso destra) — spessore 16

100.100.16

Fig. 1 *Sezione trasversale*

2100 5670 4240 1100 330 330 400 200 630 1100 1100 3940 3450 450 380 7030 560 560 950 2220

a b c d e f g h i k l m

I P.N. 38 I P.N. 42 I P.N. 40 P.N. 38 P.N. 32 P.N. 42

80.80.10 80.80.13 100.100.16 100.100.13 85.85.13 80.80.13

Scarpa pei montanti in legno

Fig. 6

320 170 210 130 15

Sezione e-f

Fig. 7

100.100.13 10 210 630

Fig. 8

100.100.13 100.100.16 85.85.13 80.80.10

Sezione g-h

I P.N. 42

Fig. 9

80.80.13 100.100.13 P.N. 38 80.80.10

Sezione i-k

I P.N. 42

80.10 100.100.13 1880

Fig. 3a *Sezione longitud.le lm*

85.85.13 100.100.13 10 510 220

Fig 3b *Pianta del pilastro*

Fig. 2 *Capriate riste di sopra*

Stabilimenti Riuniti d'Arti Grafiche - MILANO

Travi composte

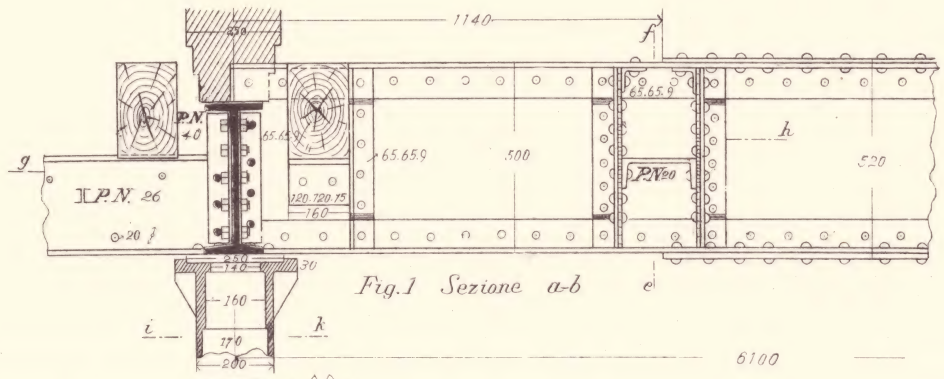


Fig. 1 Sezione a-b

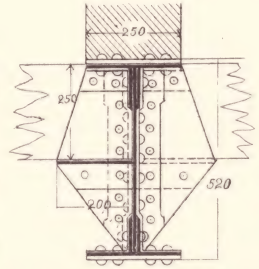


Fig. 2 Sez. e-f

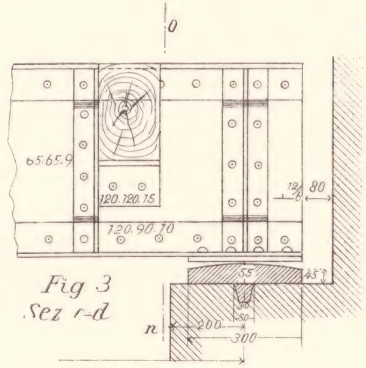


Fig 3 Sez. n-d

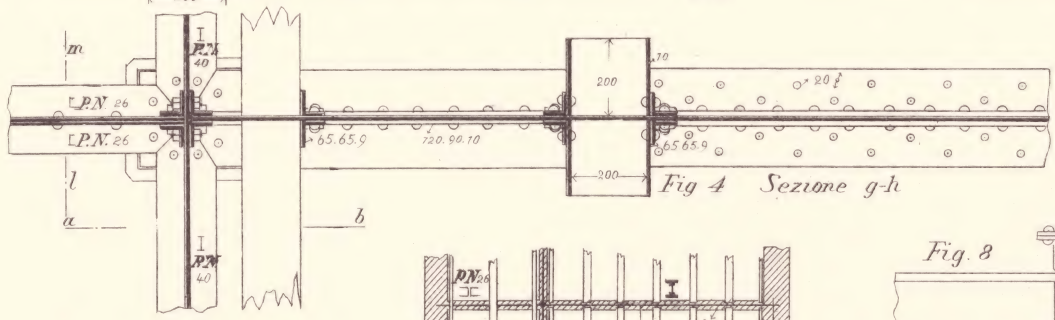
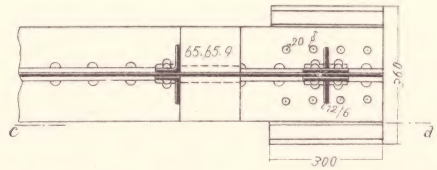


Fig. 4 Sezione g-h



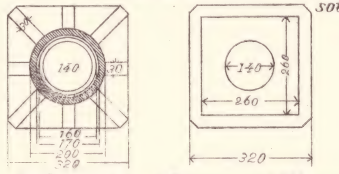


Fig. 5 Sezione i-k
(vista di sotto)

Fig. 6 Colonna vista di sotto

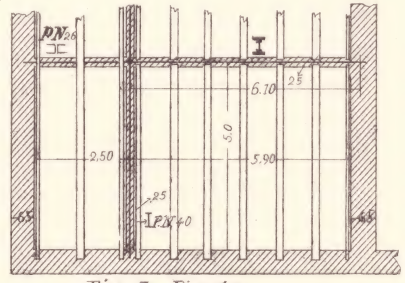


Fig. 7 Pianta

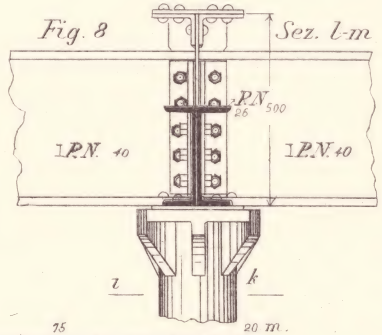


Fig. 8 Sez. l-m

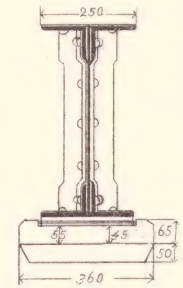
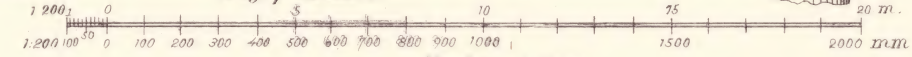
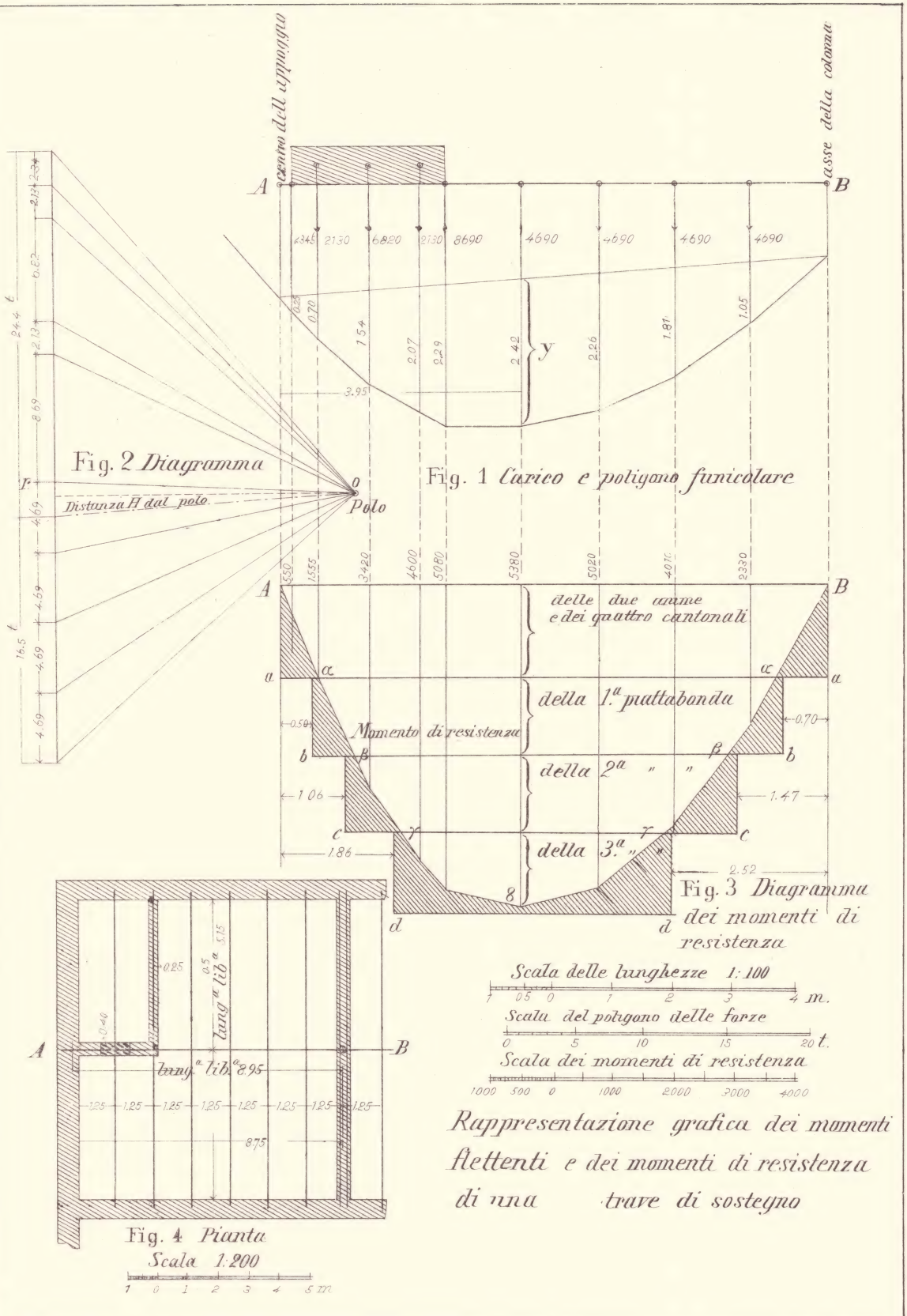


Fig. 9 Sez. n-o



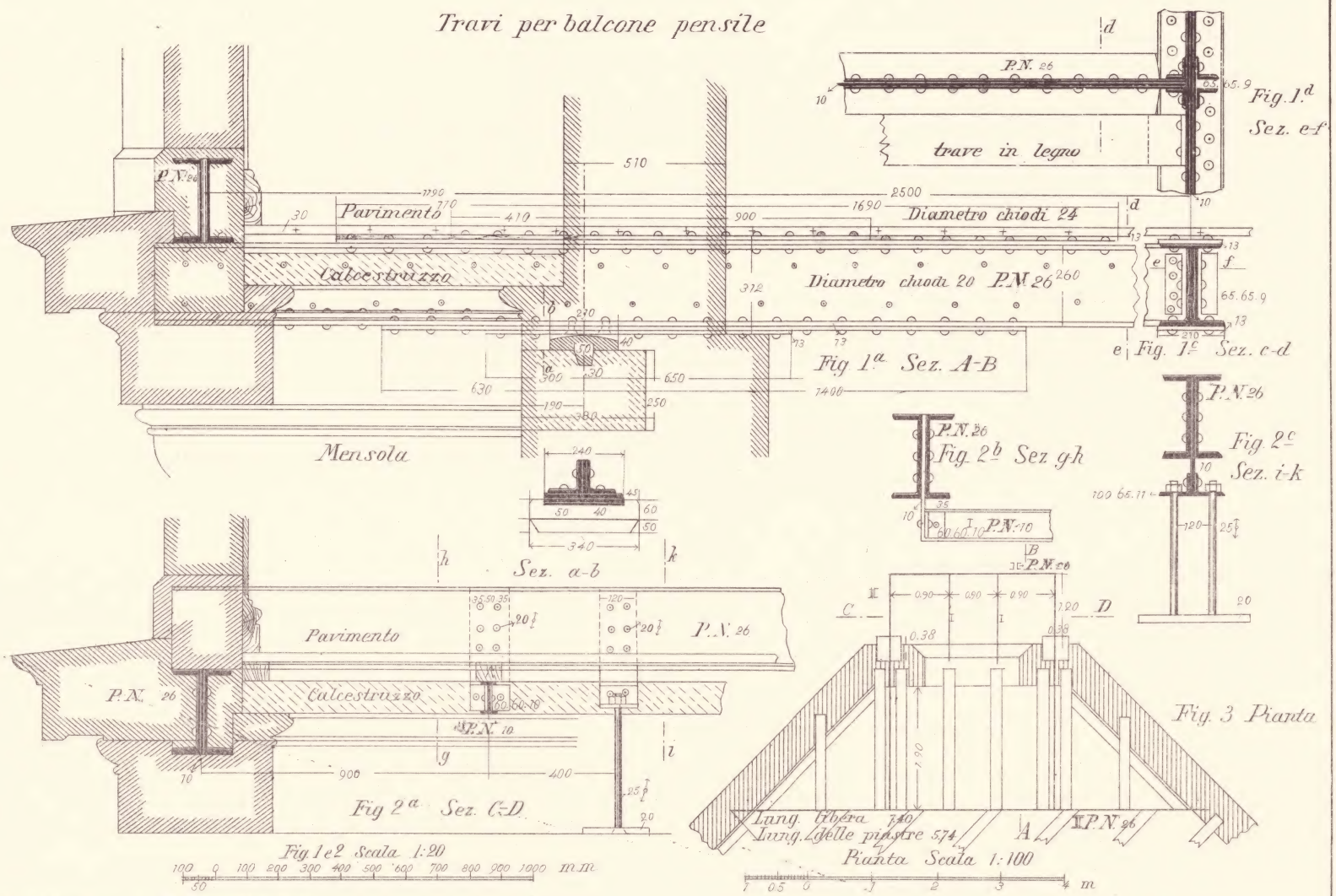
Scala 1:200

Stabilimenti Riuniti d'Arti Grafiche - MILANO



Stabilimenti Riuniti d'Arti Grafiche - MILANO

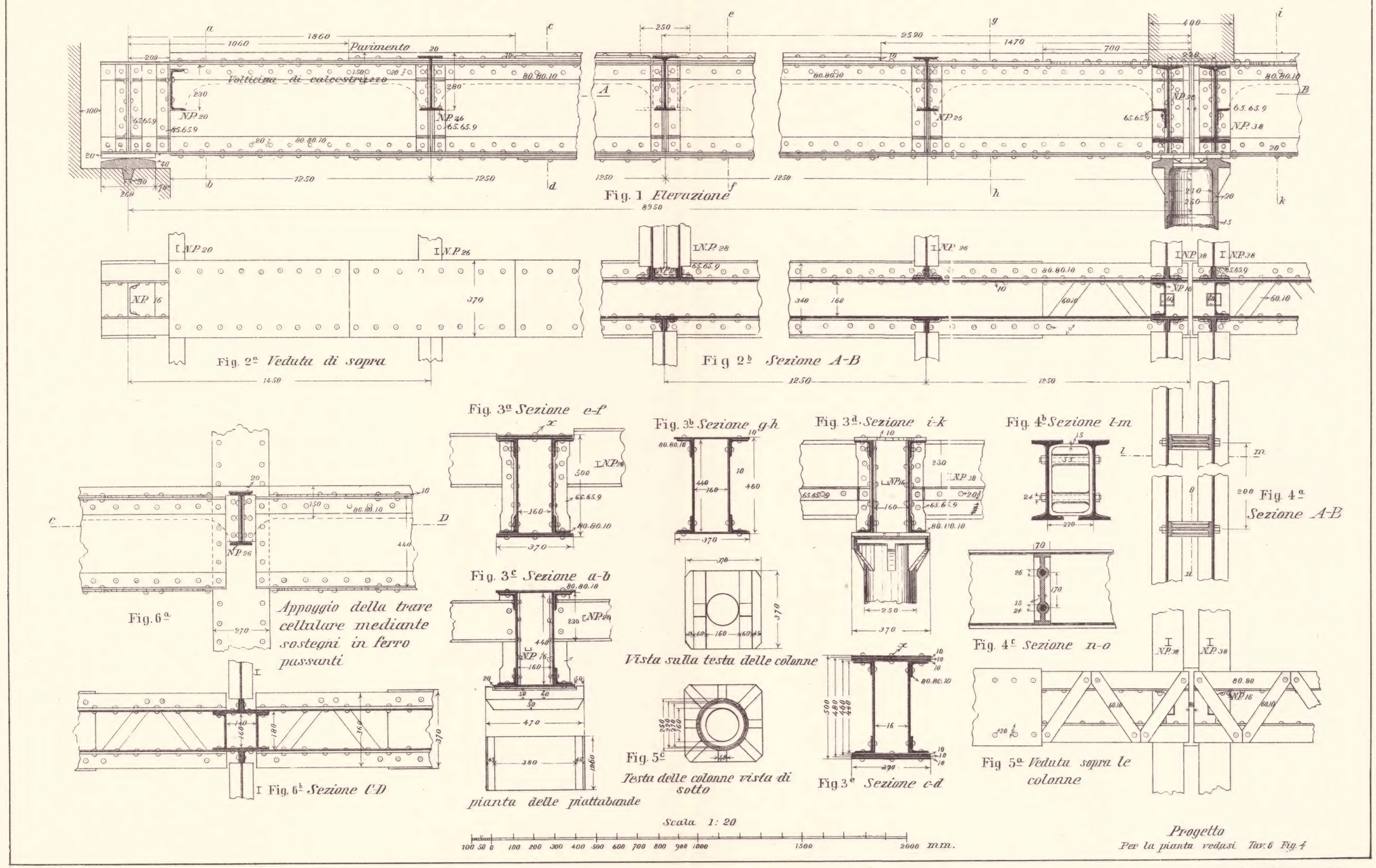
Travi per balcone pensile



Casa di abitazione in Halle sulla Sala

Stabilimenti Riuniti d'Arti Grafiche MILANO

Travi Cellulari



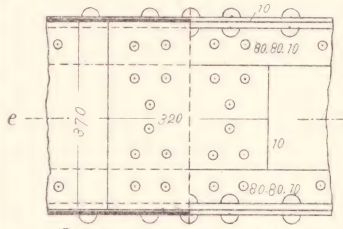
Progetto
Per la pianta vedasi Tav. 6 Fig. 4

Breymann III

Stabilimenti Riuniti d'Arti Grafiche - MILANO

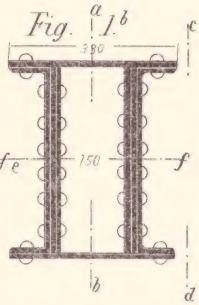
Giunti delle travi composte

Fig. 1.a



Sez. a-b Prospetto c-d

Fig. 1.b



Giunto dell'anima nelle travi cellulari

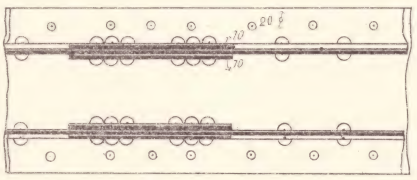


Fig. 1.c Sez. e-f

Fig. 2.a

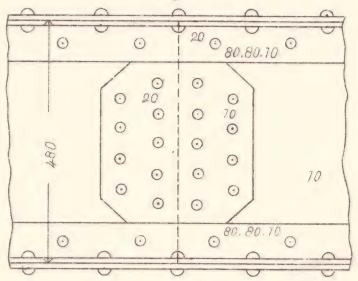
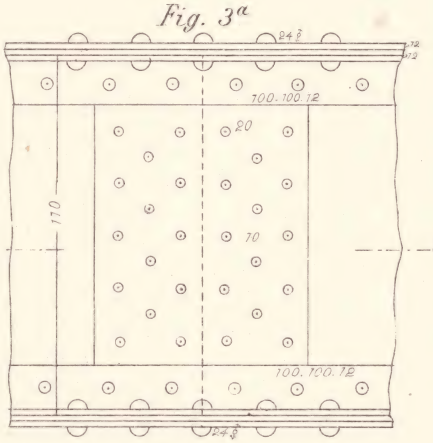


Fig. 2.b

Giunto dell'anima per travi semplici

Fig. 3.a



Giunto dell'anima per travi pesanti

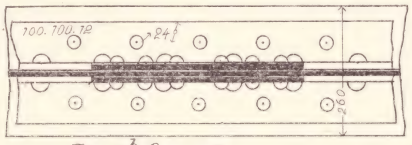
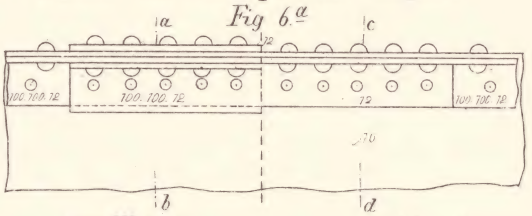


Fig. 3.b Sez. a-b

Fig. 6.a



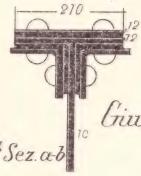
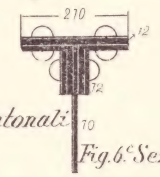


Fig. 6.



Giunto dei cantonali

Fig. 6.b Sez. a-b Fig. 6.c Sez. c-d

Fig. 4.a

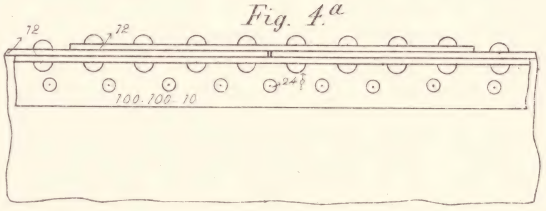


Fig. 4 Giunto di una piattabanda

Fig. 4.b

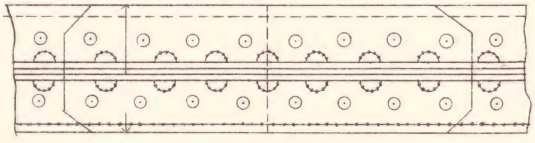


Fig. 5.a Coprig.to di più piattabande

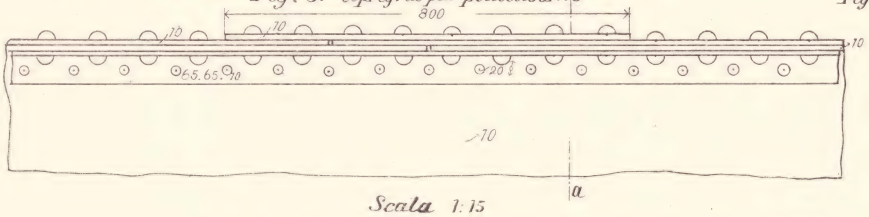
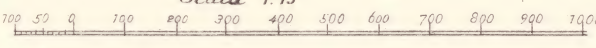


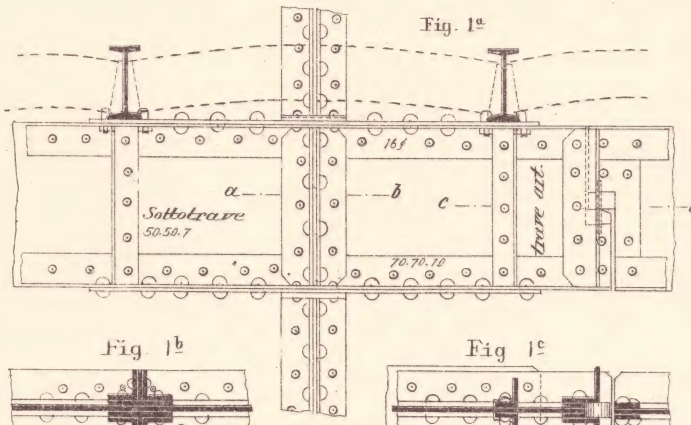
Fig. 5.b Sez. a-b

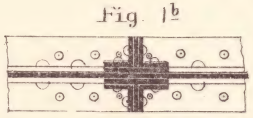
Scala 1:15

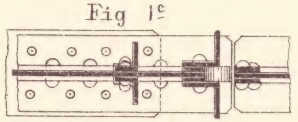


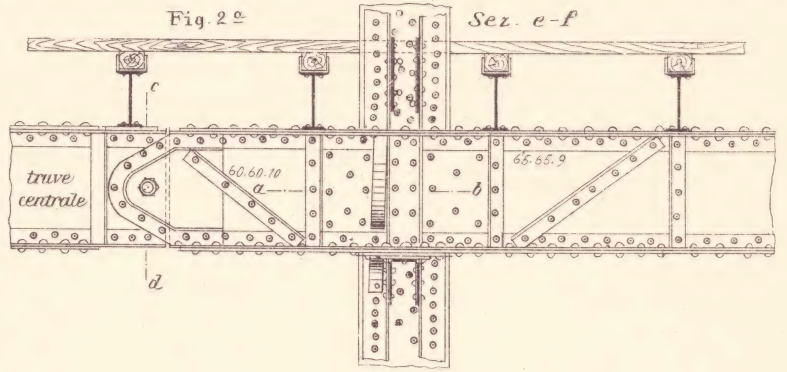
Stabilimenti Riuniti d'Arti Grafiche - MILANO

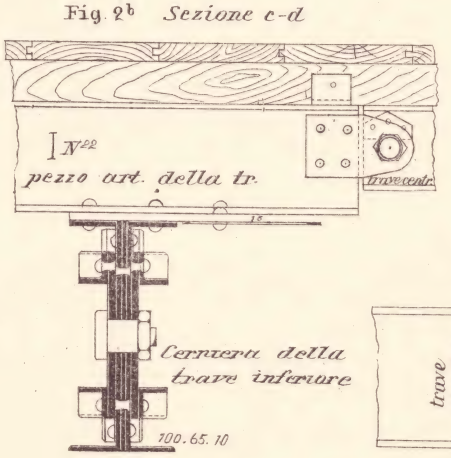
Trave articolata a cerniera

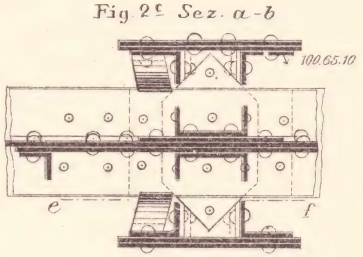


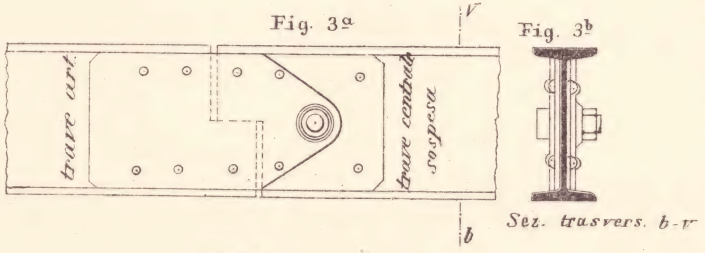


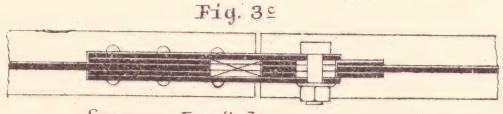


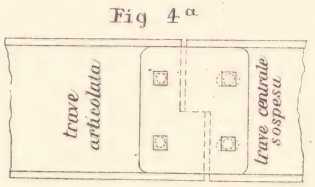


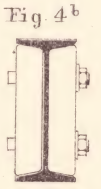












Scala 1:15

100 50 0 100 200 300 400 500 600 700 800 900 1000 m.m

Scala 1:30

100 0 500 1000 m.m

Stabilimenti Riuniti G. Arte Grafiche MILANO

Capriata Francese

Determinazione grafica delle tensioni del traliccio

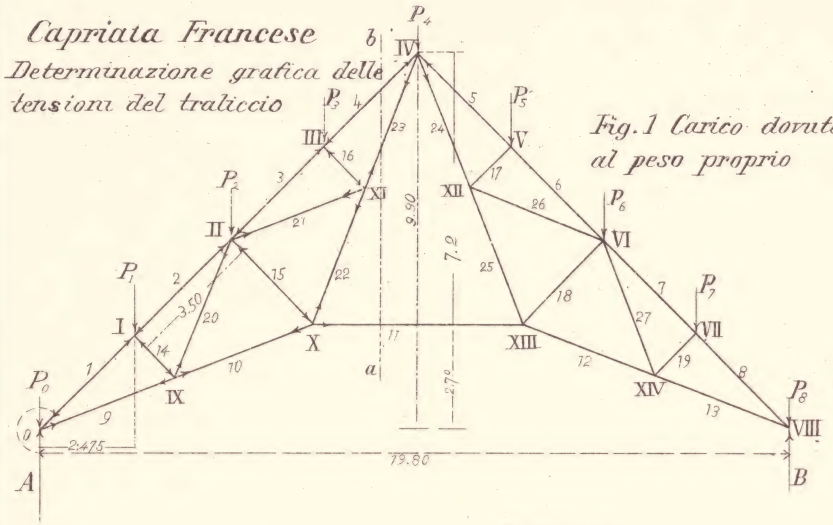


Fig. 1 Carico dovuto al peso proprio

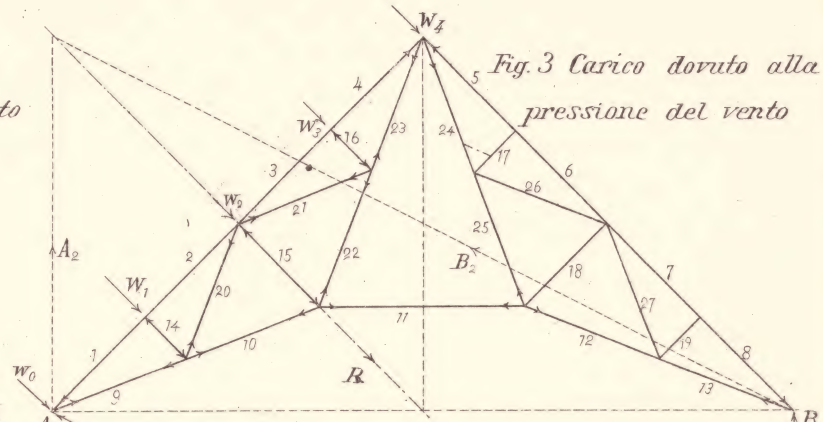


Fig. 3 Carico dovuto alla pressione del vento

nei diagrammi Fig. 2. 4. 5.

indica forza esterna
sforzo di compressione
sforzo di trazione

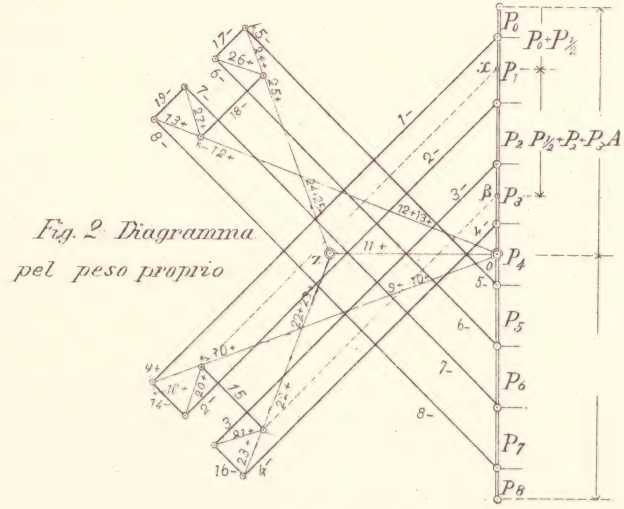


Fig. 2 Diagramma pel peso proprio

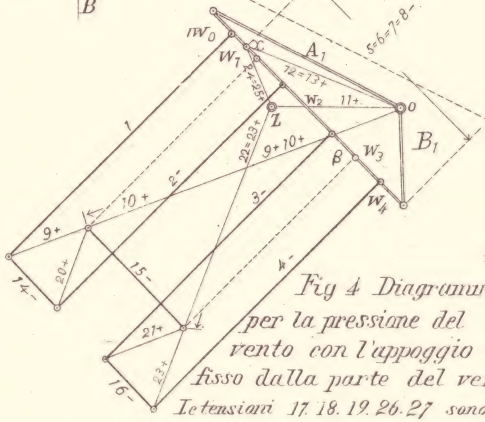
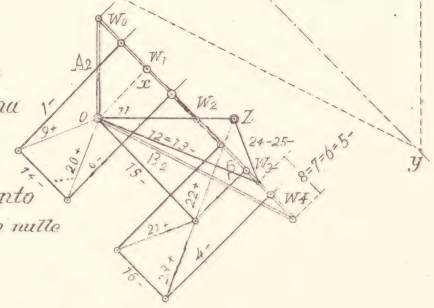


Fig 4 Diagramma per la pressione del vento con l'appoggio fisso dalla parte del vento

Le tensioni 17. 18. 19. 26. 27 sono nulle



Scala delle lunghezze 1.200
delle forze 1 tonnellata = 0.5 cm.

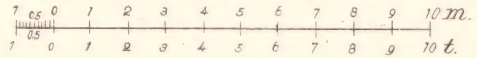


Fig. 5 Diagramma per la pressione del vento, con l'appoggio mobile dalla parte del vento.

Le tensioni 10. 17. 18. 19. 26. 27 sono nulle

Bregnana III

Stabilimenti Pizzarotti & Arti Grafiche - MILANO

Capriata inglese

Determinazione grafica delle tensioni del traliccio

Fig. 1ª *Carico dovuto al peso proprio*

Fig. 1ᵇ *Carico dovuto alla neve*

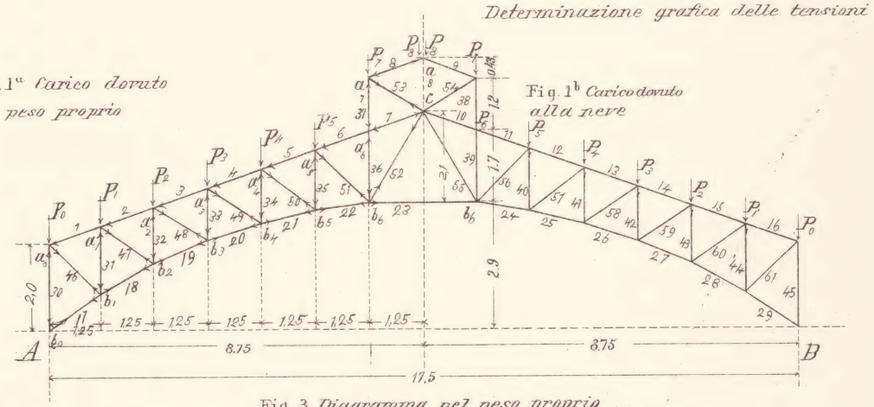


Fig. 3 *Diagramma pel peso proprio*
La tensione nelle sbarre 17, 29, 50 e 57 è nulla

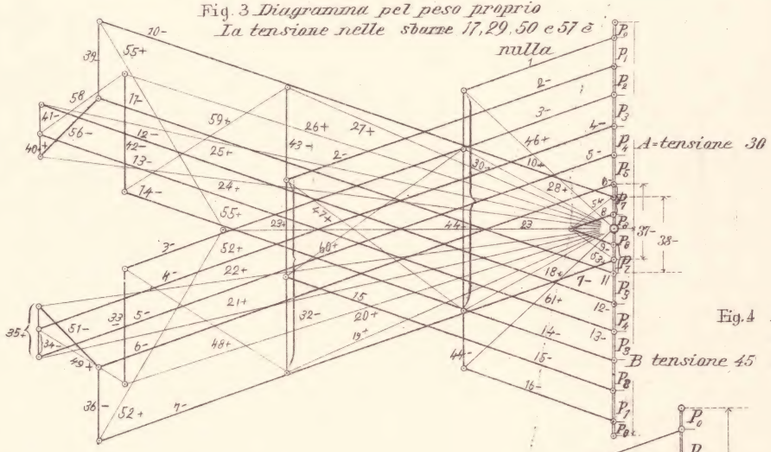


Fig. 4 *Diagramma pel carico unilaterale dovuto alla neve*

La tensione nelle sbarre 17 e 29 è nulla

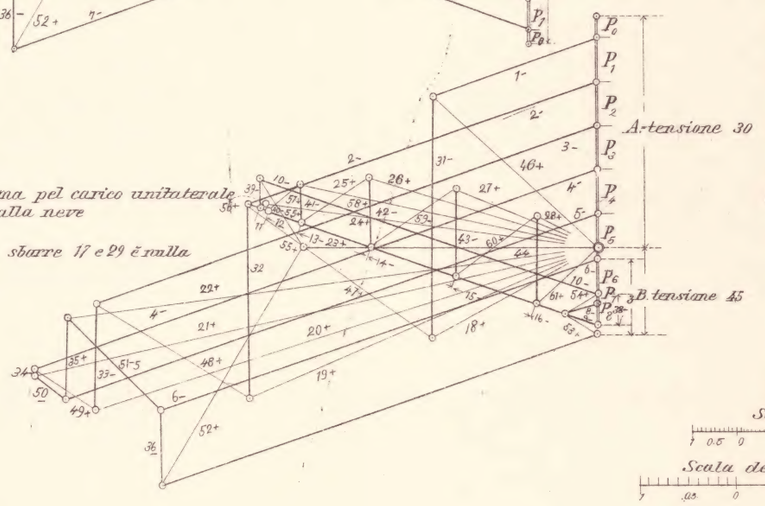


Fig. 2
Carico dovuto al vento

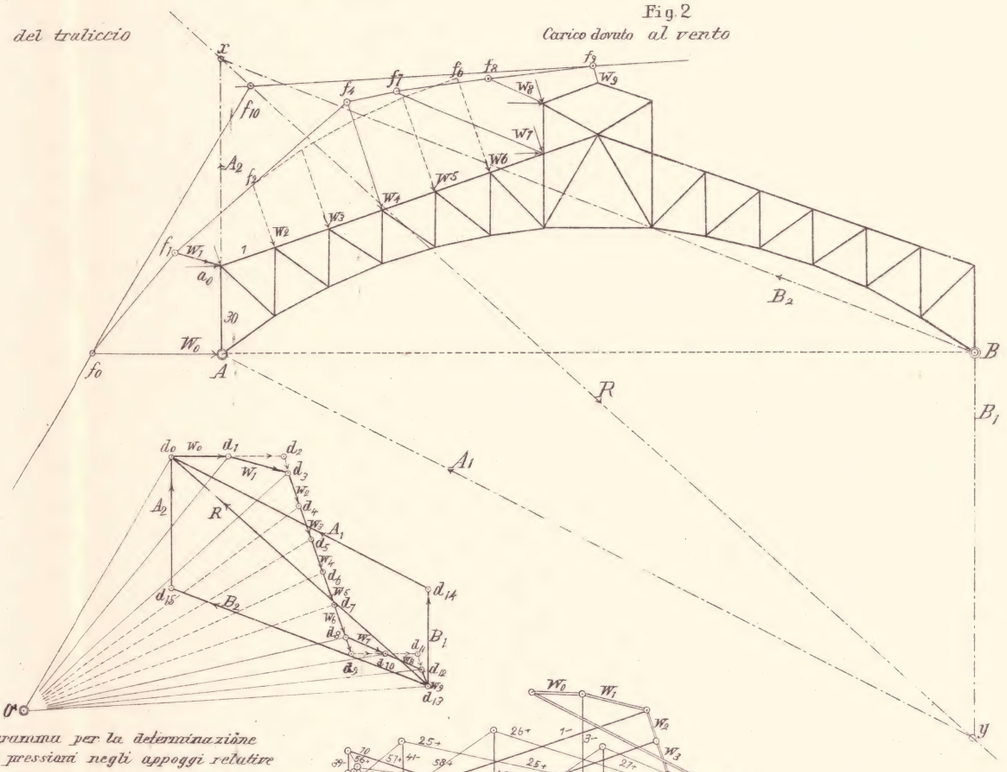


Fig. 4 *Diagramma per la determinazione delle pressioni negli appoggi relative al carico dovuto al vento*

Fig. 5
Diagramma pel carico dovuto al vento e per l'appoggio fisso dalla parte del vento
Le tensioni della sbarra 45=B e quella nella sbarra 29=0

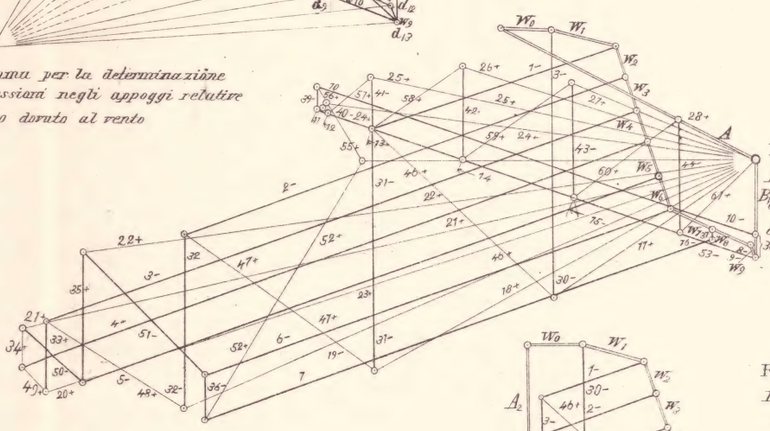
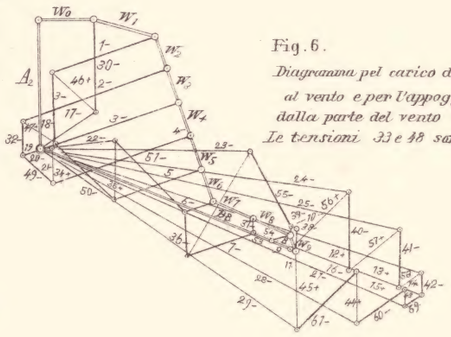
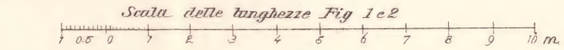


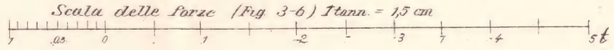
Fig. 6.
Diagramma pel carico dovuto al vento e per l'appoggio mobile dalla parte del vento
Le tensioni 33 e 48 sono nulle



Scala delle lunghezze Fig 1 e 2



Scala delle forze (Fig 3-6) 1 tann. = 1,5 cm



Stabilimento Ricordi di Arti Grafiche - MILANO

Disposizione del solaio e del tetto sopra una sala illuminata dall'alto

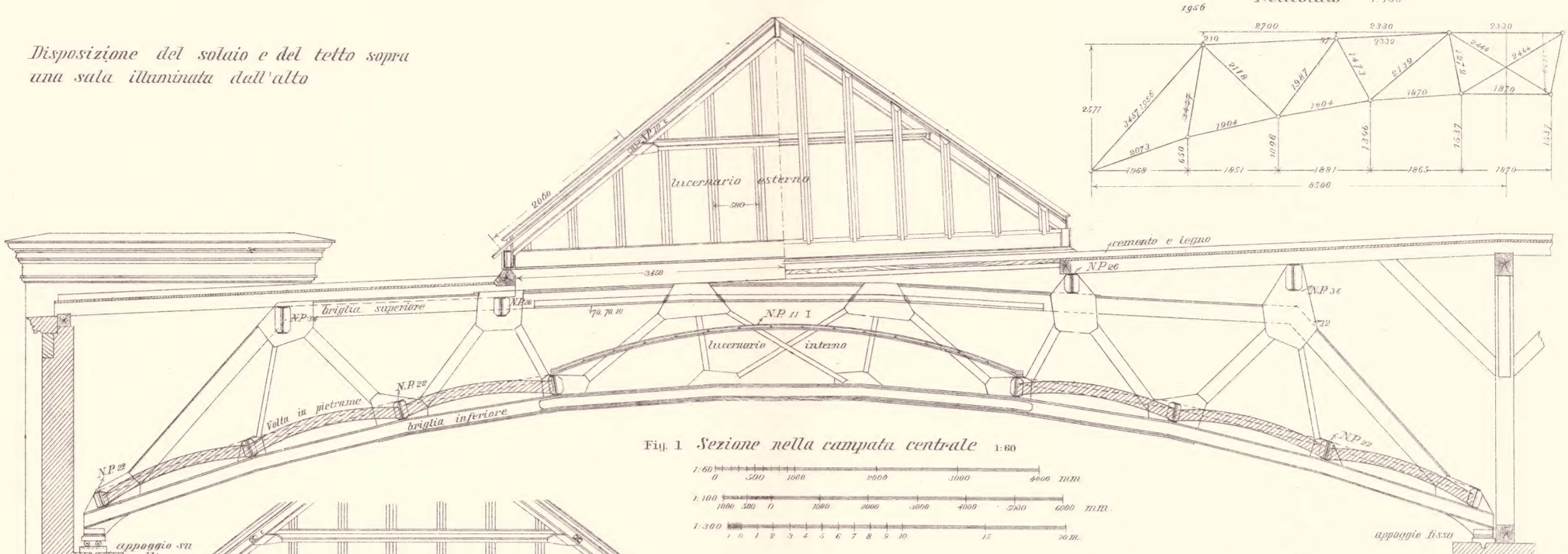
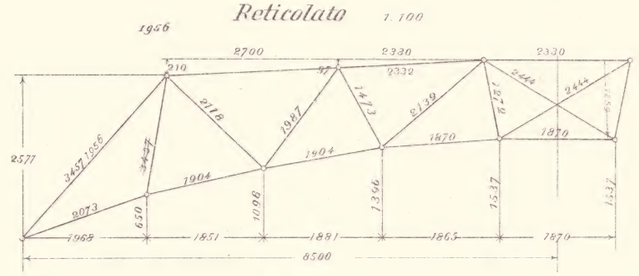


Fig. 1 *Sezione nella campata centrale* 1:60



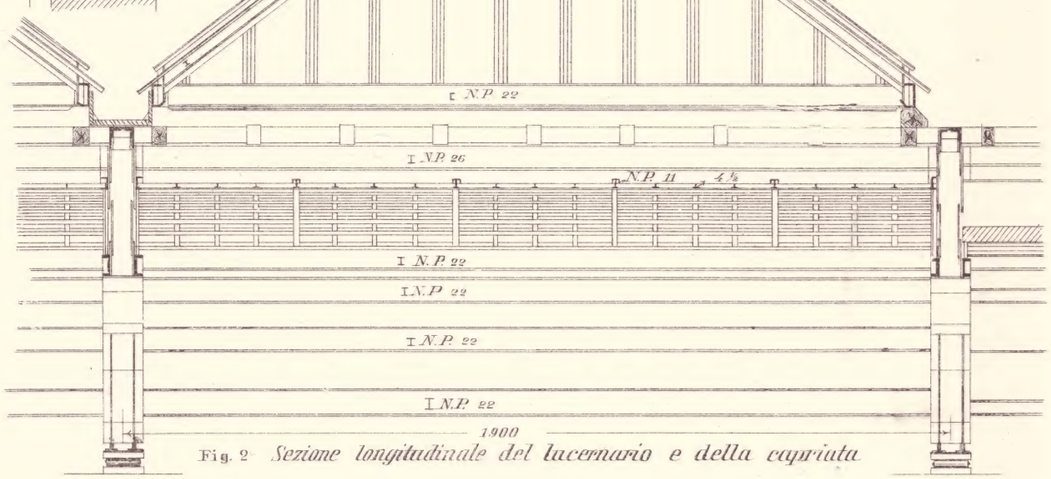


Fig. 2 *Sezione longitudinale del lucernario e della capriata*

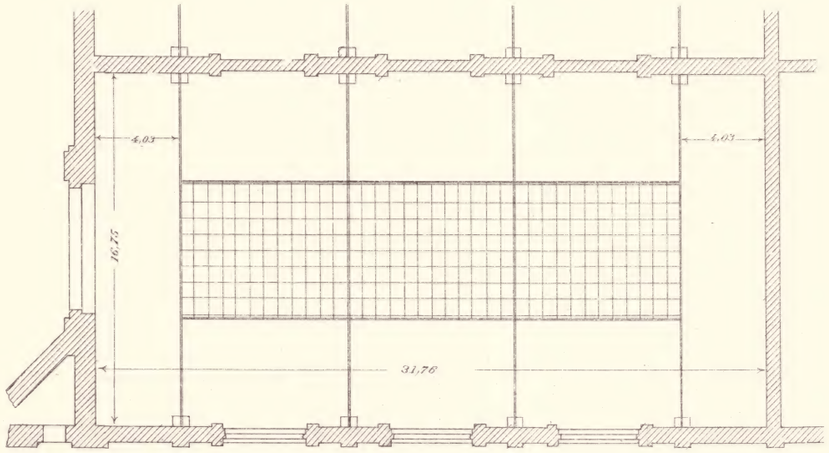
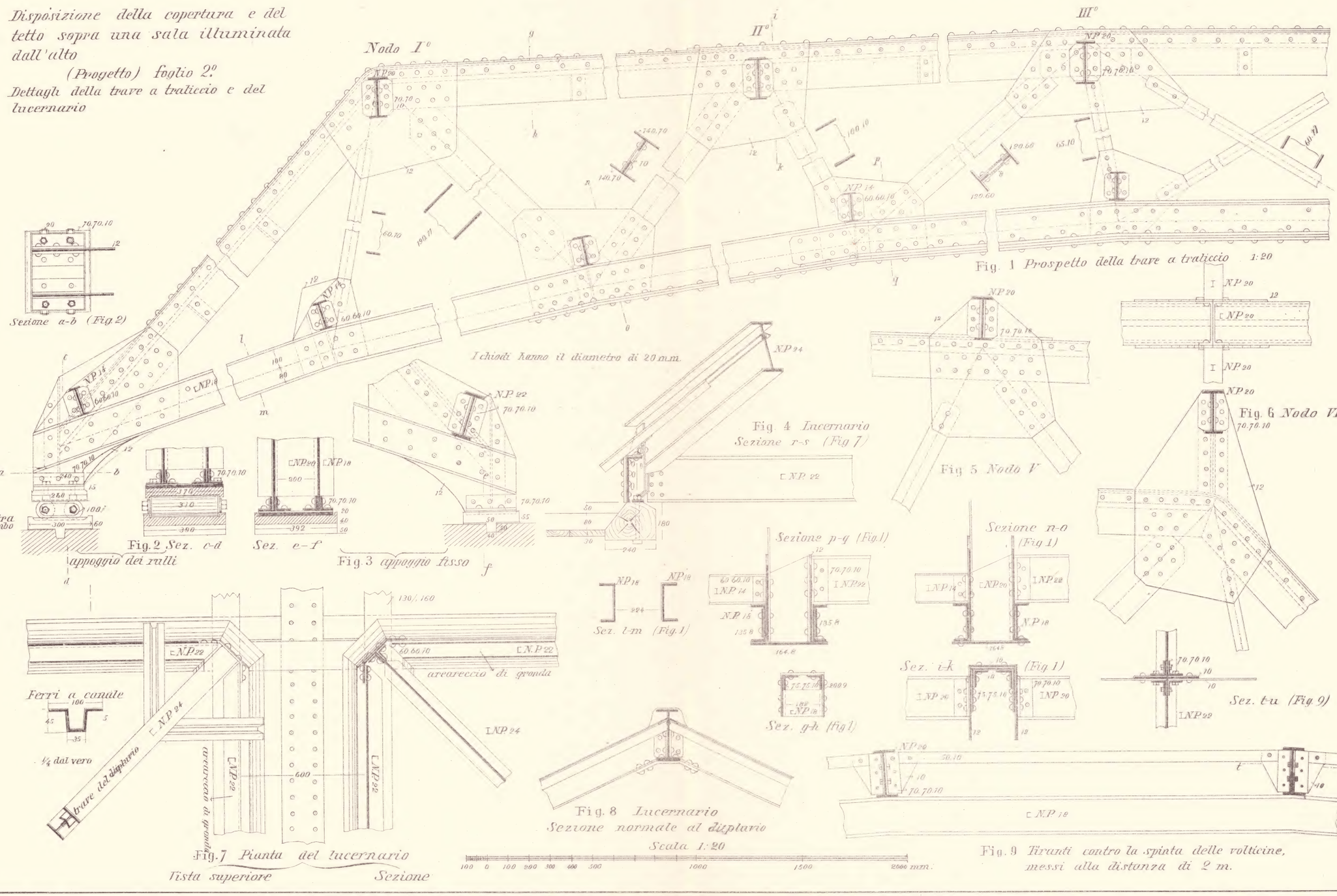


Fig 3 *Pianta* 1:300

Stabilimenti Pirotti d'Arti Grafiche MILANO

Disposizione della copertura e del tetto sopra una sala illuminata dall'alto
(Progetto) foglio 2°
Dettagli della trave a traliccio e del lucernario



Stabilimenti Riuniti G. Arti Grafiche MILANO

Solaio sulla gran sala delle sedute dell'edifizio del Tribunale di Lipsia

Scala 1:20

50 100 0 100 200 300 400 500 1000 m/m

Scala 1:100

1 0.5 0 1 2 3 4 m.

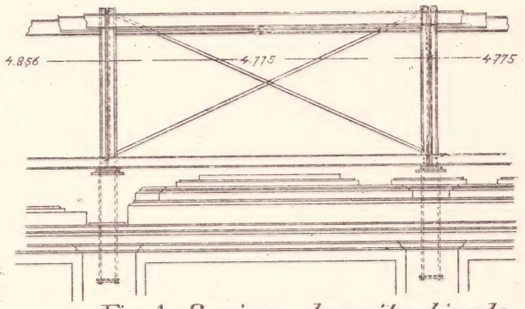


Fig. 1 *Sezione longitudinale*

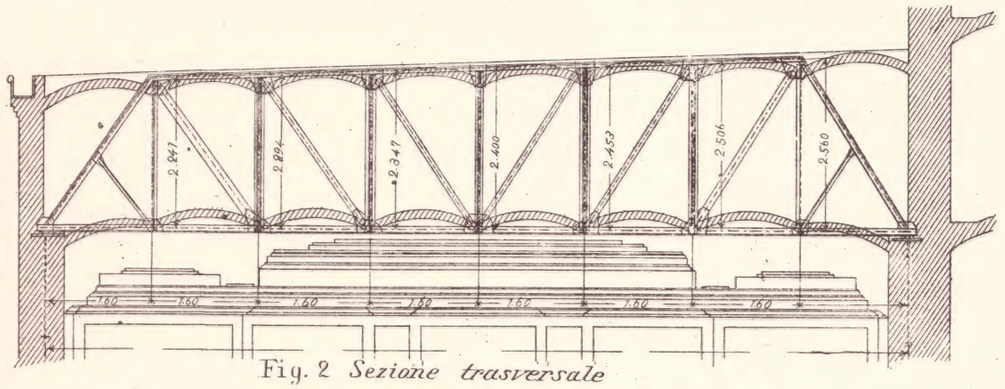


Fig. 2 *Sezione trasversale*

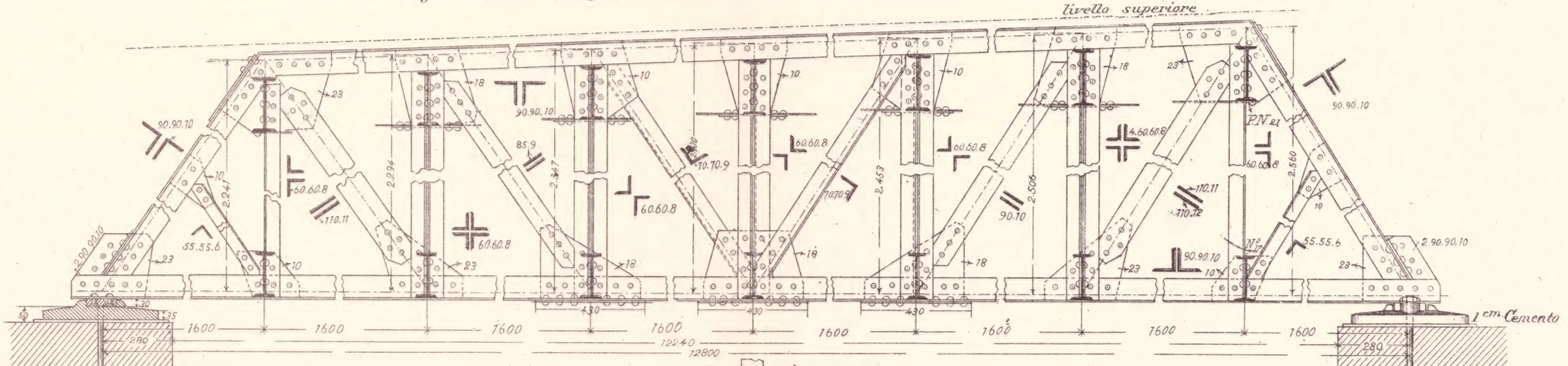


Fig. 3 *Vista longitudinale della trave a traliccio*

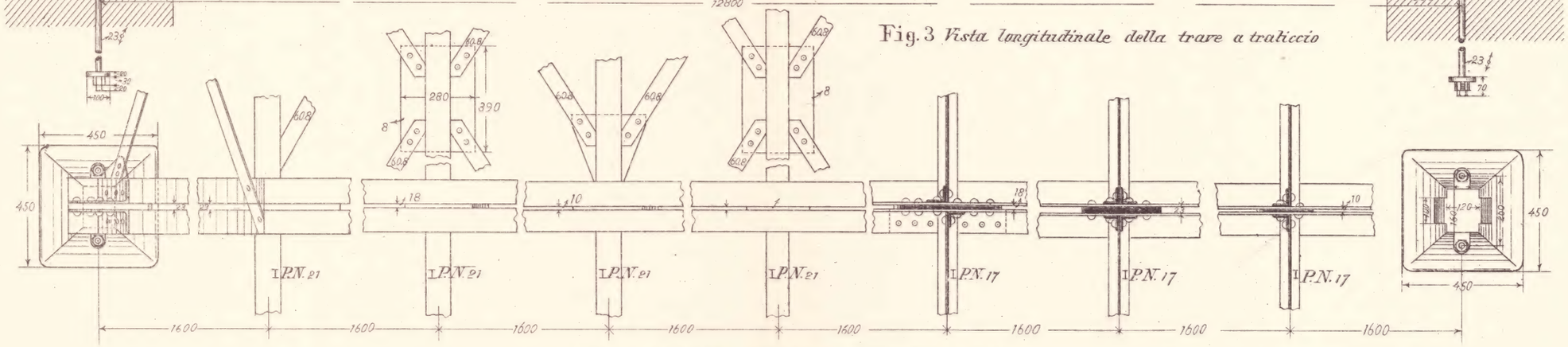


Fig. 4 *Proiezione orizzontale della trave a traliccio*

R. Cramer. Ing.

L. Hofmann, Arch.

Breymann III

Stabilimenti Riuniti d'Arti Grafiche - MILANO

Tav. 27

Tetto e solaio sul Salone del Tribunale di Lipsia (progetto)

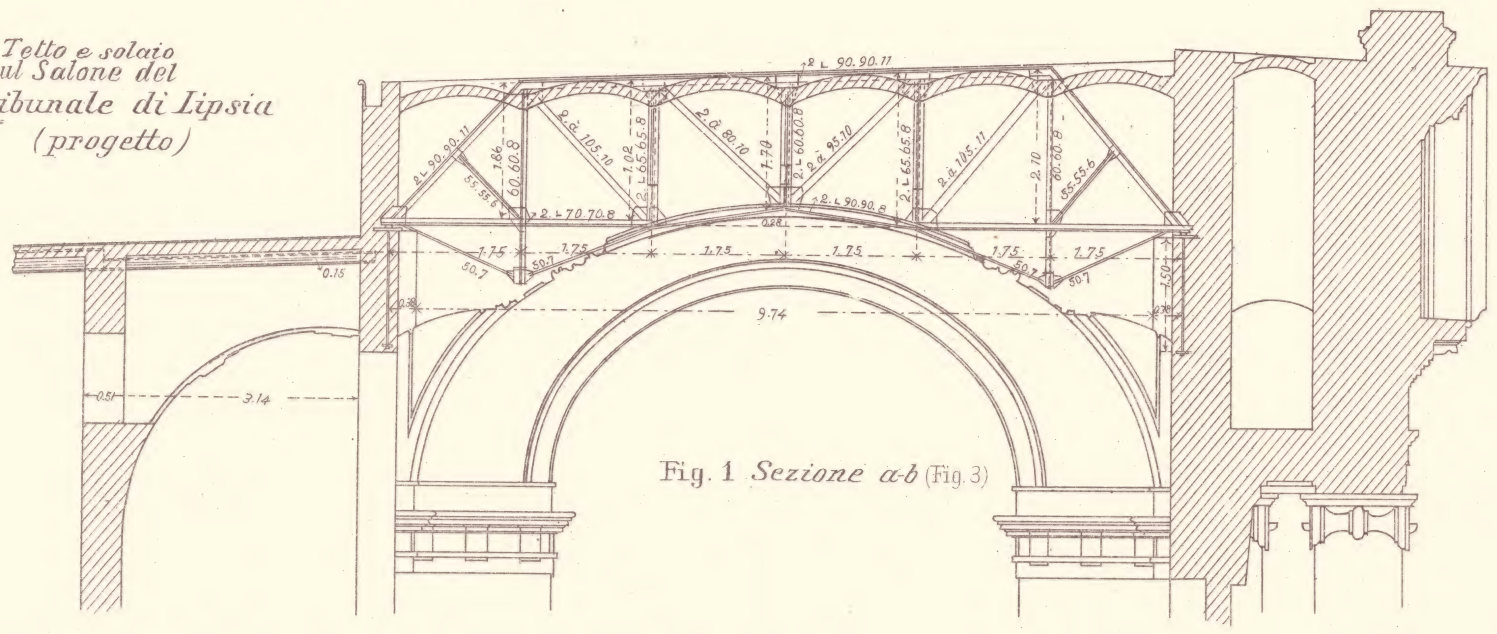


Fig. 1 *Sezione a-b* (Fig. 3)

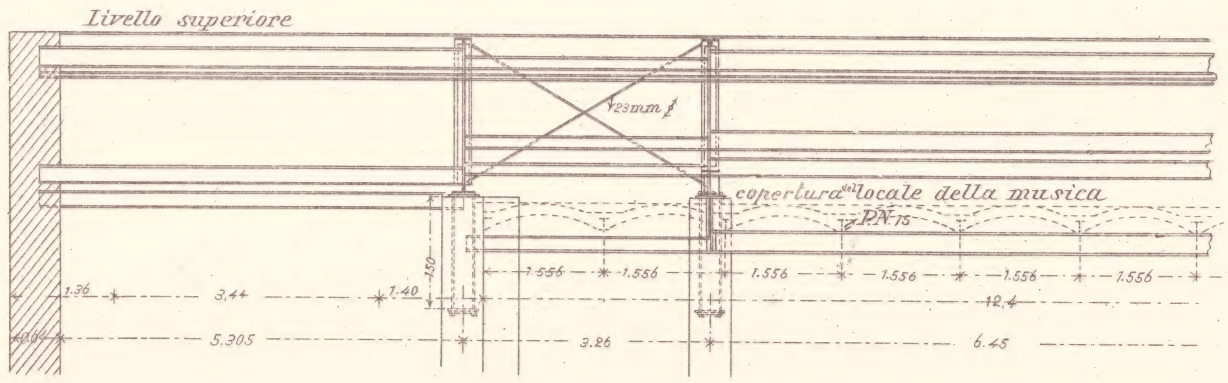


Fig. 2 *Sezione c-d* (Fig. 3)

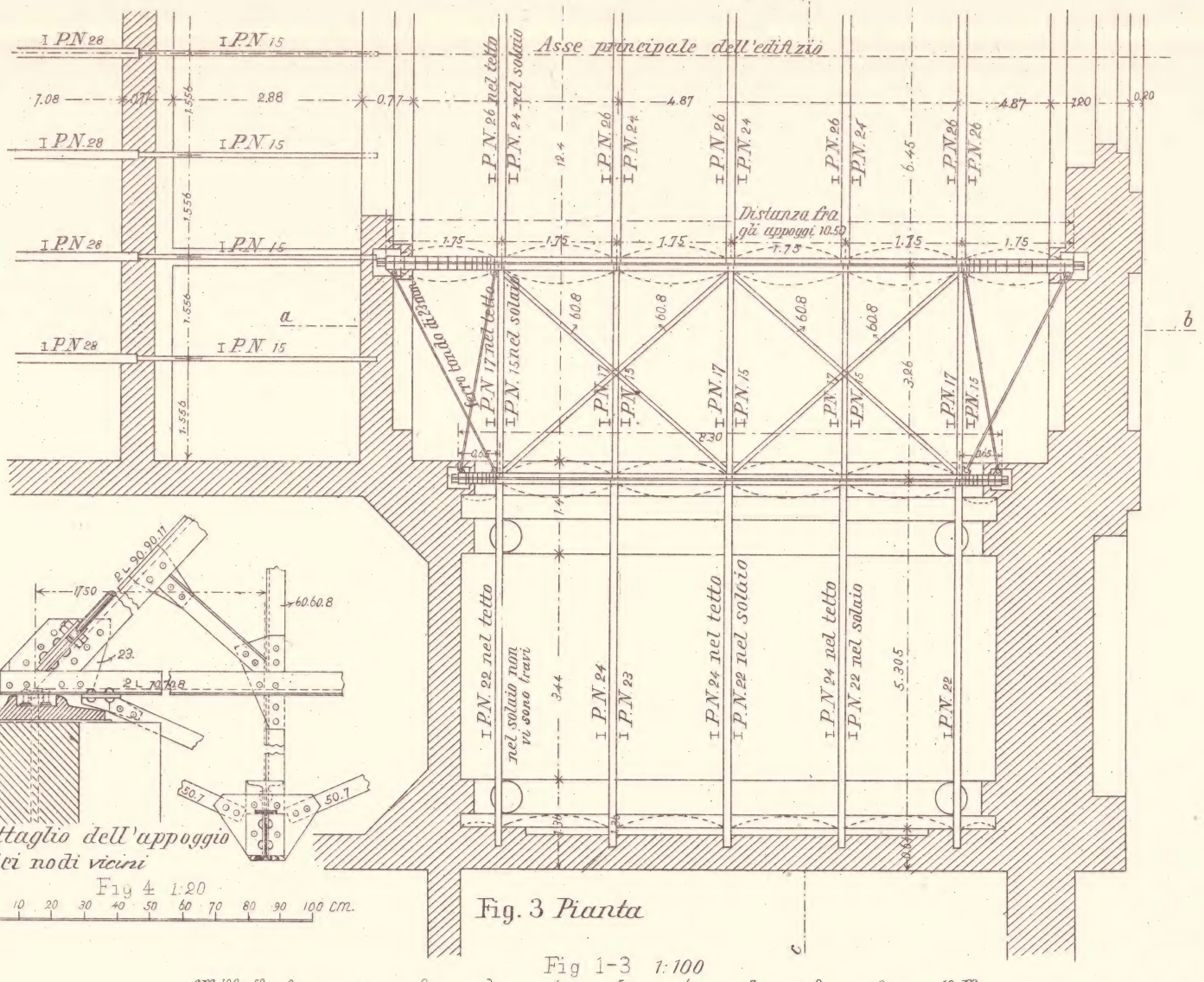


Fig. 3 *Pianta*

Fig 1-3 1:100

cm. 100 50 0 1 2 3 4 5 6 7 8 9 10 m.

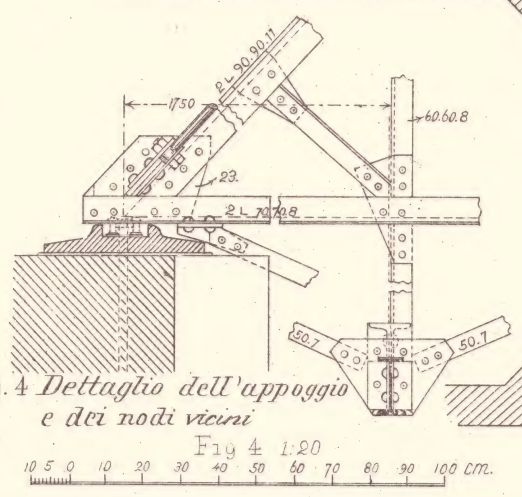


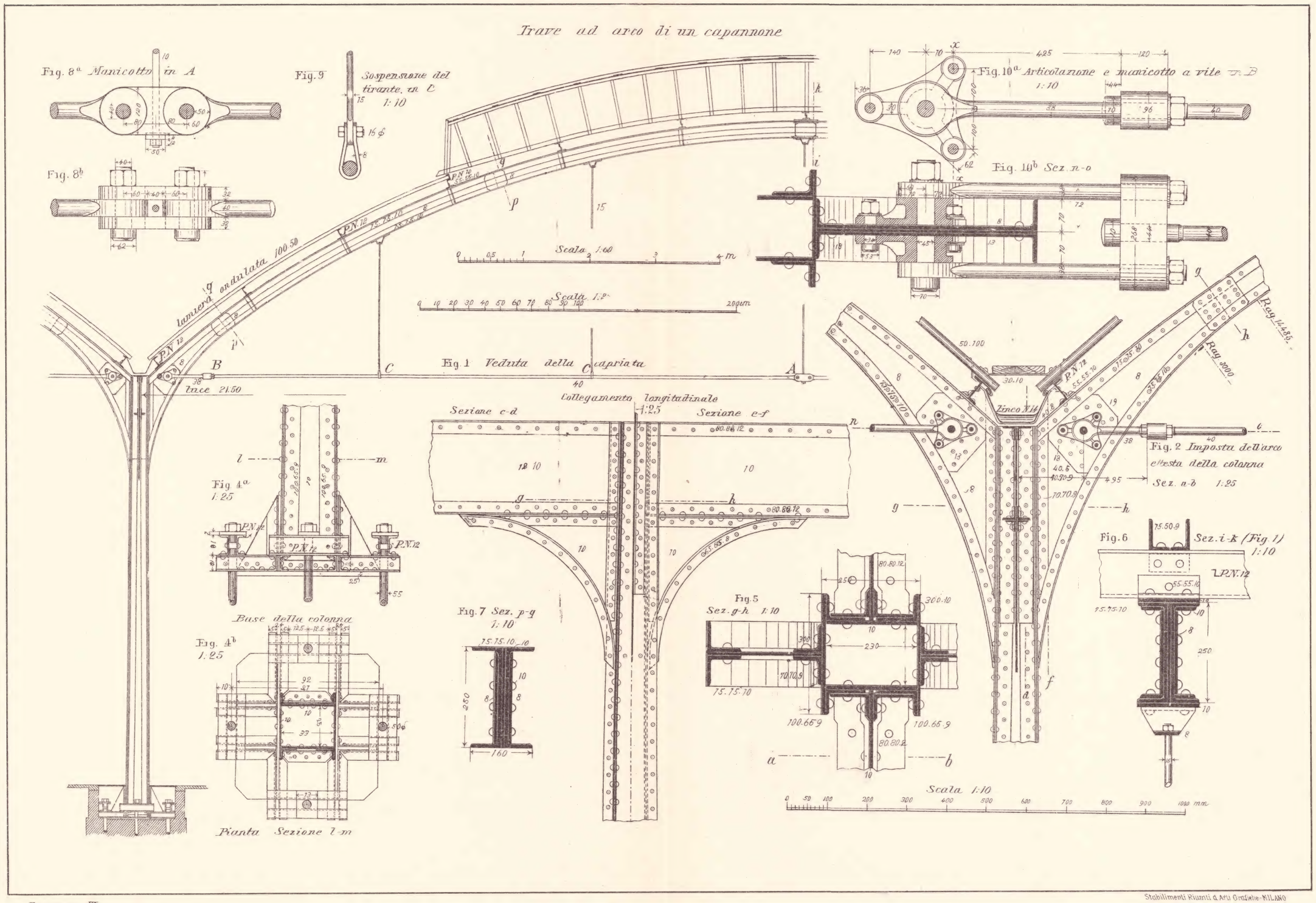
Fig. 4 *Dettaglio dell'appoggio e dei nodi vicini*

Fig 4 1:20

10 5 0 10 20 30 40 50 60 70 80 90 100 cm.

Stabilimenti Riuniti d'Arte Grafiche MILANO

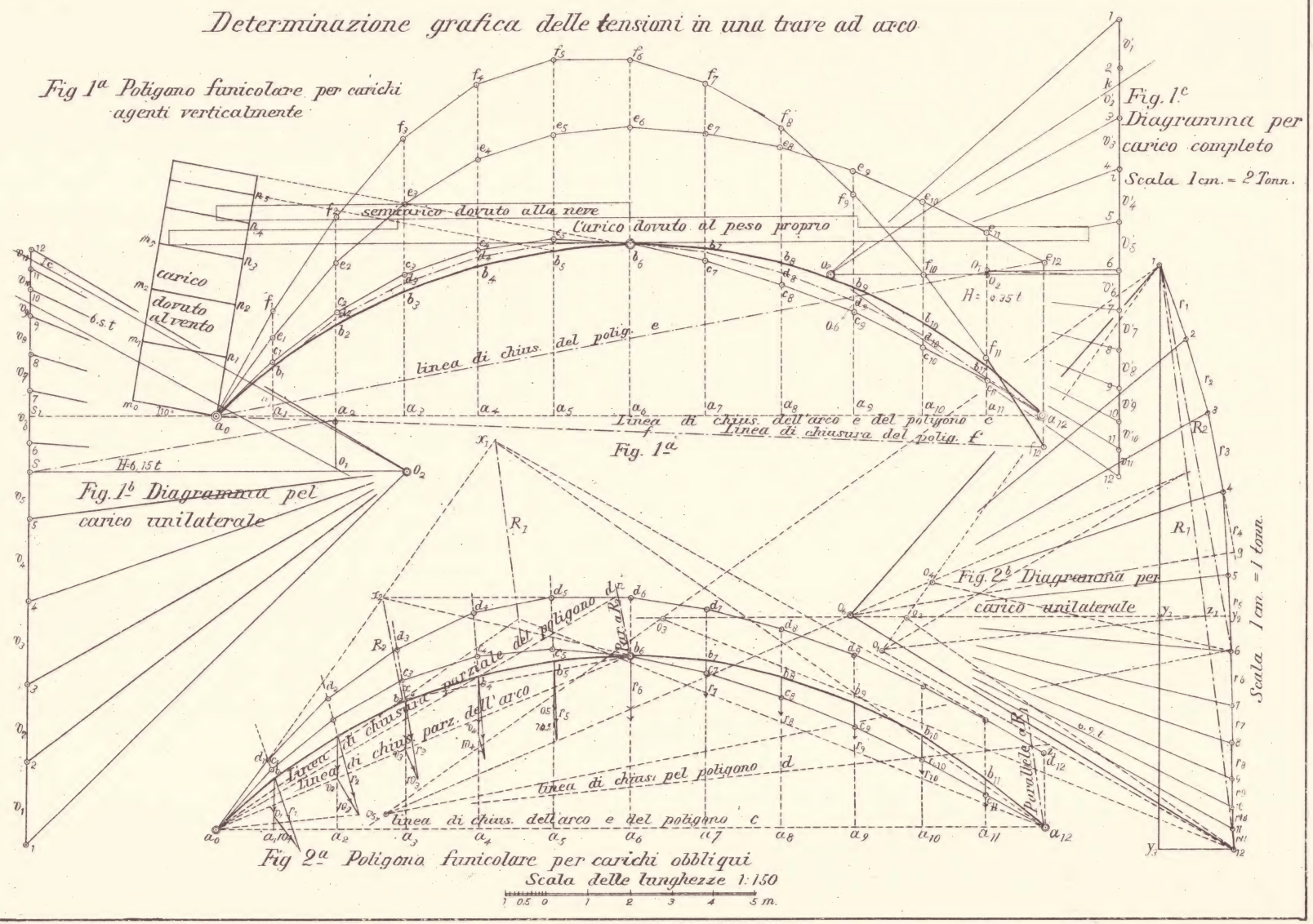
Bregmann III



Breymann III

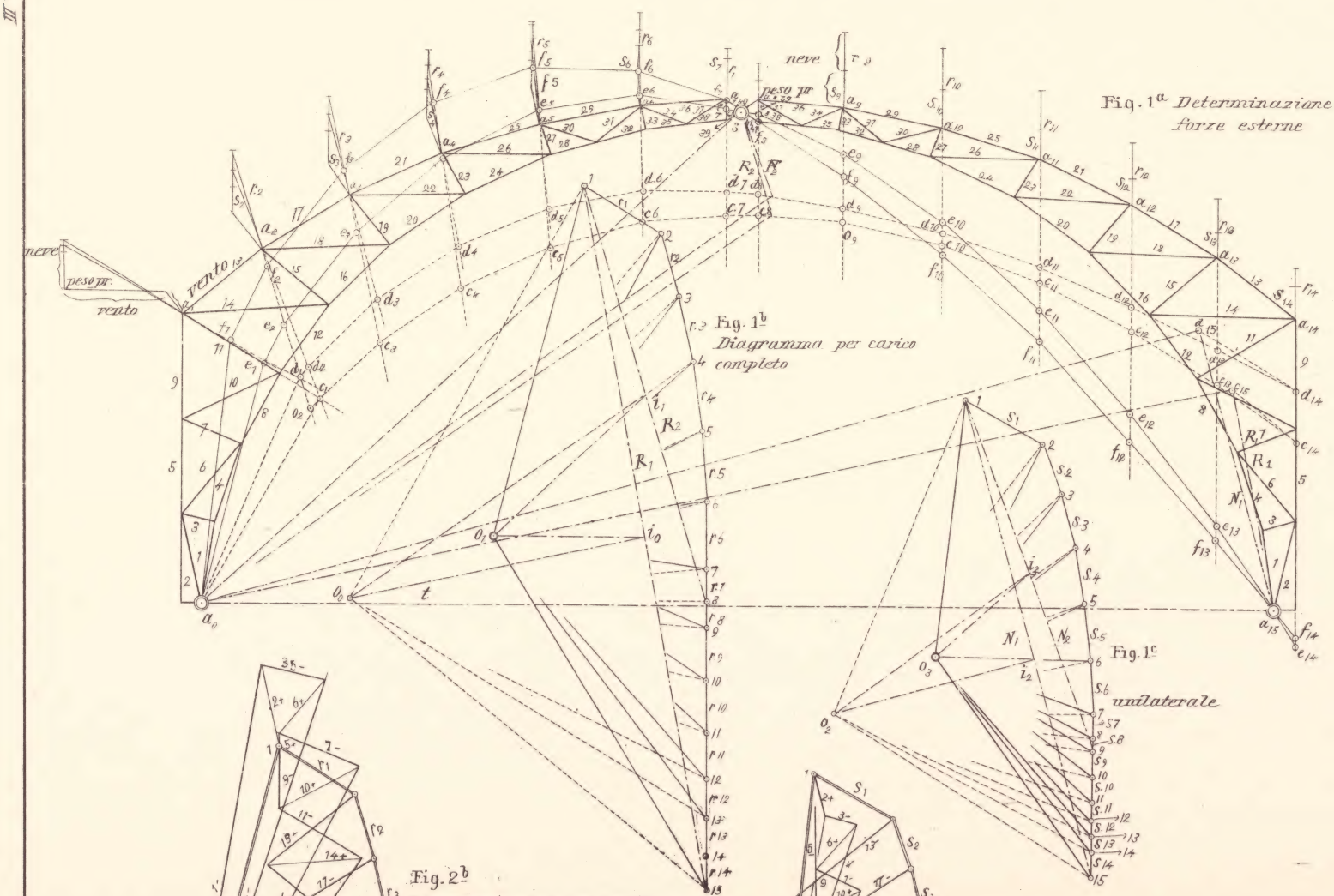
Stabilimenti Riuniti d'Arti Grafiche - MILANO

Determinazione grafica delle tensioni in una trave ad arco



Stabilimenti Riuniti d'Arti Grafiche - MILANO

Determinazione grafico delle tensioni in un arco a traliccio



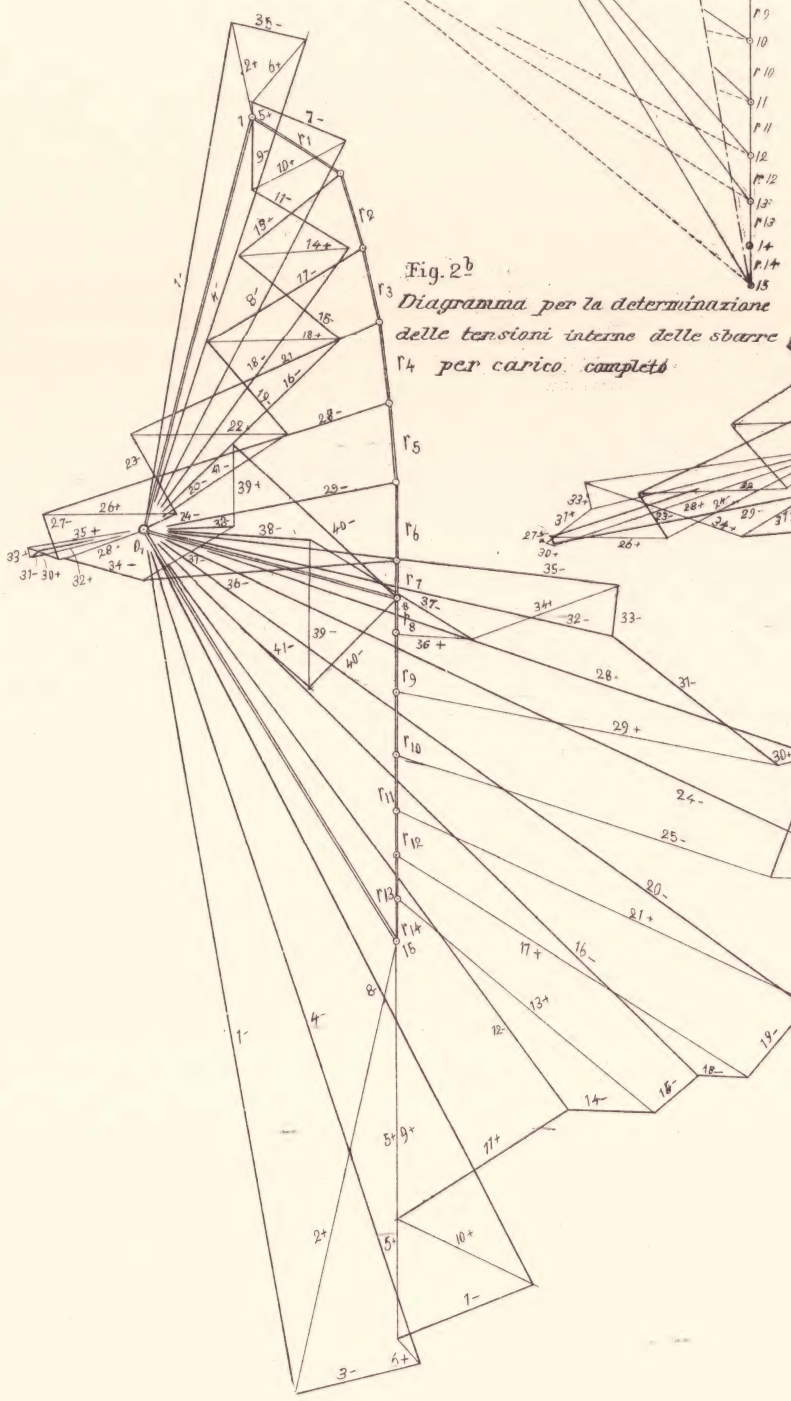


Fig. 2b
Diagramma per la determinazione delle tensioni interne delle sbarre r4 per carico completo

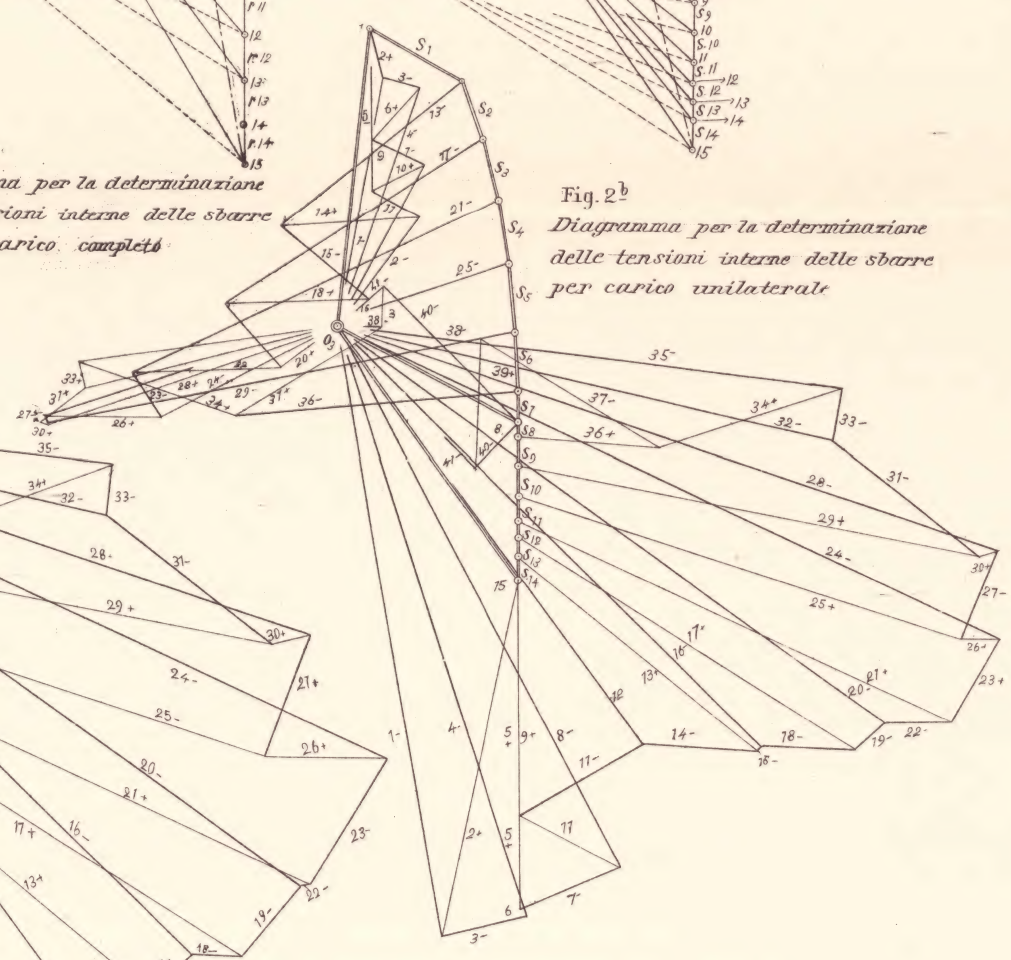


Fig. 2b
Diagramma per la determinazione delle tensioni interne delle sbarre per carico unilaterale

Scala delle lunghezze 1:120

Scala delle forze per la fig 1a 1 cm = 1 tonn

Scala delle forze per la fig 1b - 2b 1 cm = 1.5 tonn.

Stabilimenti Ricordi & Arti Grafiche MILANO

Tettoia della stazione Alexanderplatz (foglio 2)

Fig. 2.
Sezione a-b 1:50

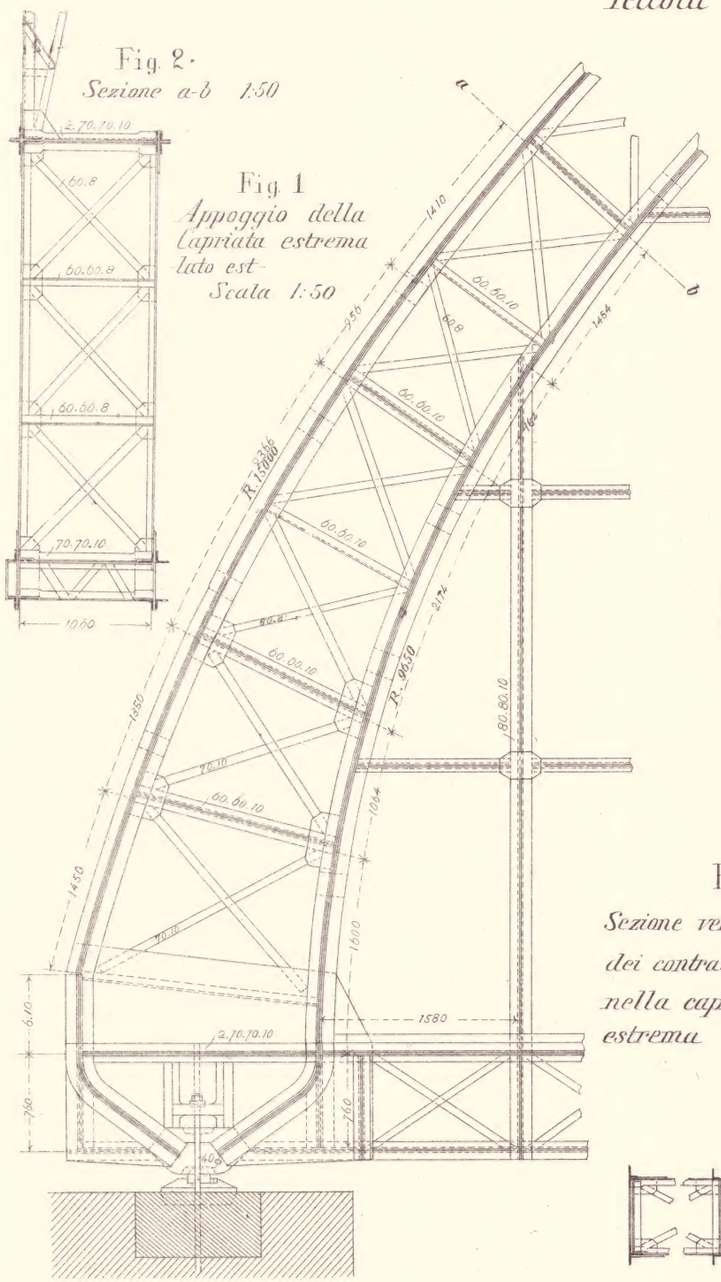


Fig. 1
Appoggio della capriata estrema lato est
Scala 1:50

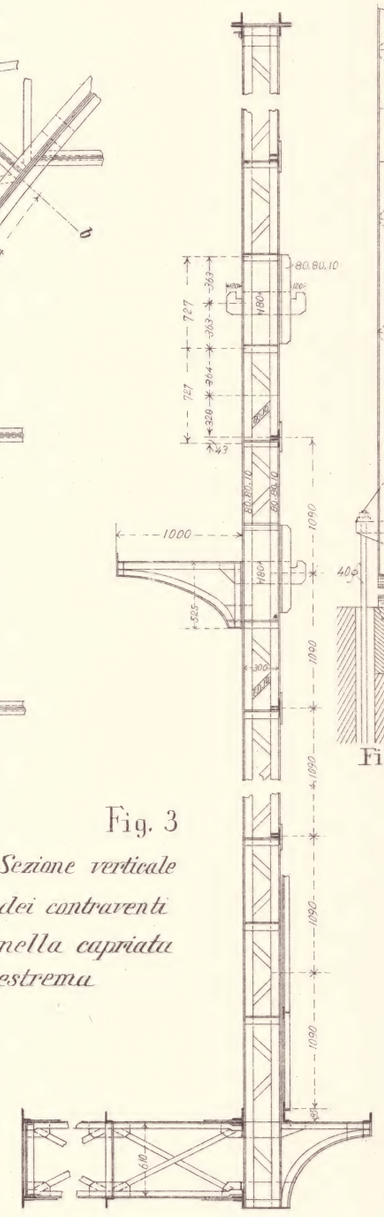


Fig. 3
Sezione verticale dei contraventi nella capriata estrema

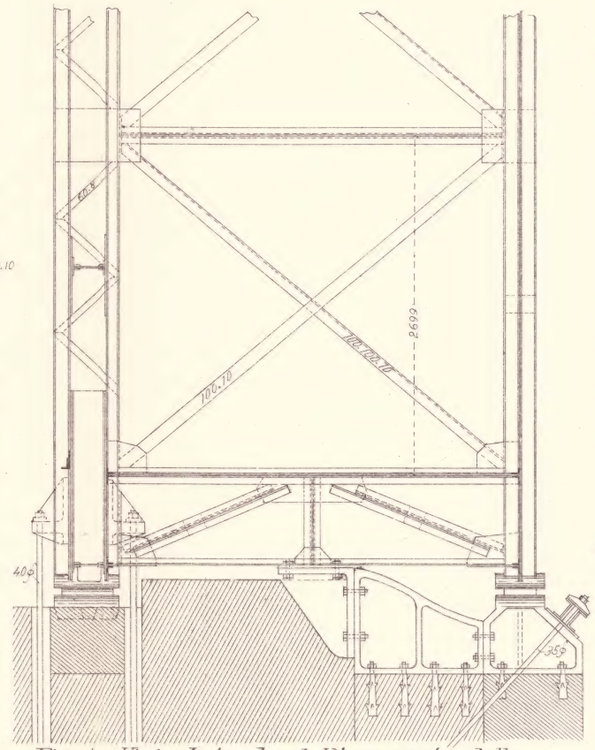
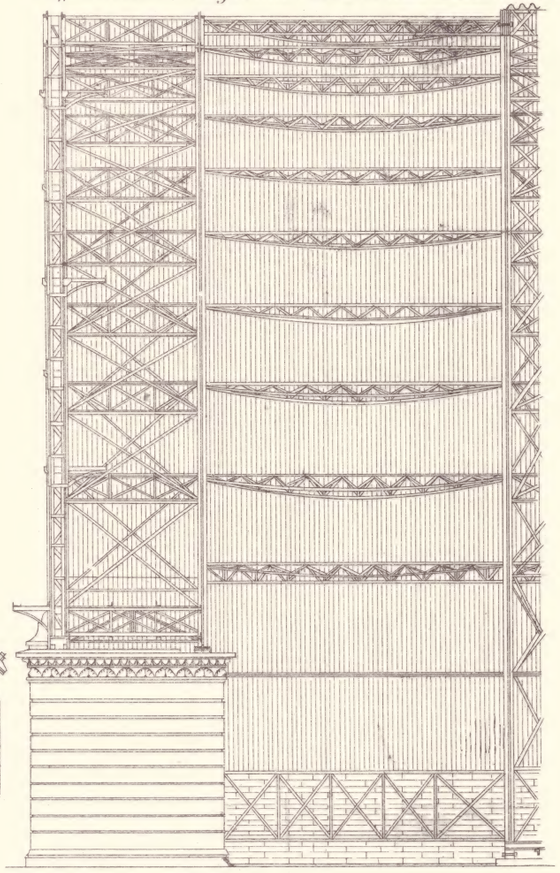
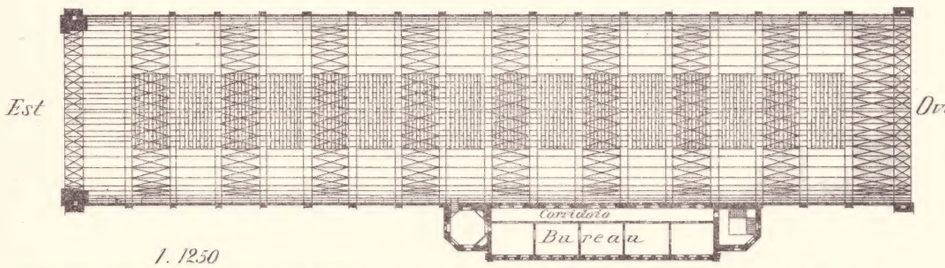


Fig. 4 Vista laterale dell'appoggio della capriata estrema - lato est -
Scala 1:50

Fig. 5 Sezione longitudin.le della tettoia verso l'estr.o est





1. 1250
10 8 6 4 2 0 10 20 30 40 50 60 m.

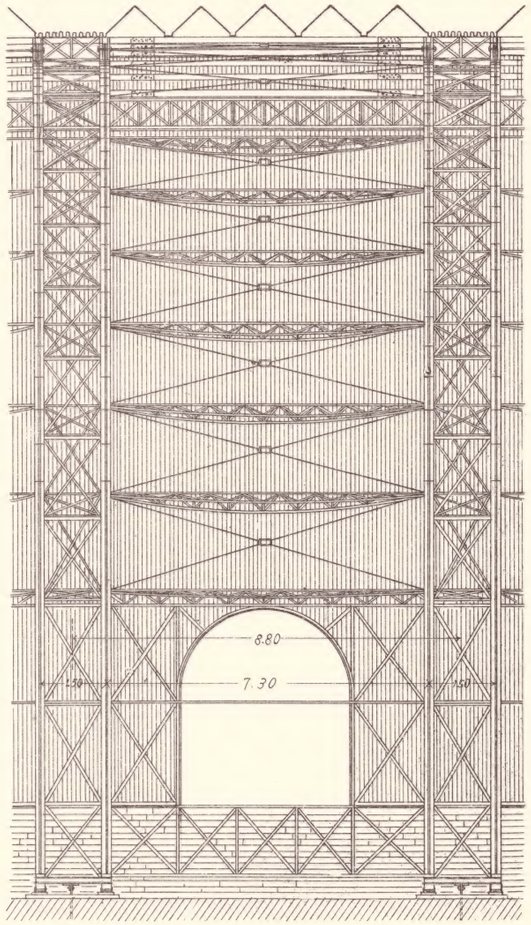
Pianta della tettoia 1. 1250

1. 50
cm. 100 60 60 40 20 0 1 2 3 m.

1. 150
1 0.5 0 1 2 3 4 5 6 7 8 m.

Stabilimenti Riuniti d Arti Grafiche MILANO

Fig. 1 *Sezione longitudinale della tettoia*



Sc. 1:150 1 0 1 2 3 4 5 6 7 8 9 10 m *per le Fig 1 e 2*

Sc. 1:50 m 100 90 80 70 60 50 40 30 20 10 0 1000 2000 3000 mm *per le Fig. 3–10*

Tettoia sul marciapiedi della stazione Alexanderplatz della ferrovia metropolitana di Berlino

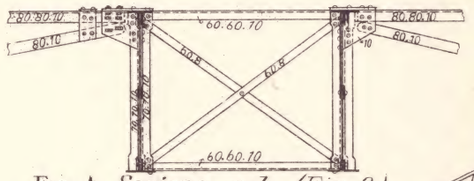


Fig. 4 *Sezione a-b (Fig. 2)*

Fig. 3 *Attacco degli arcarecci alle capriate* 1:50

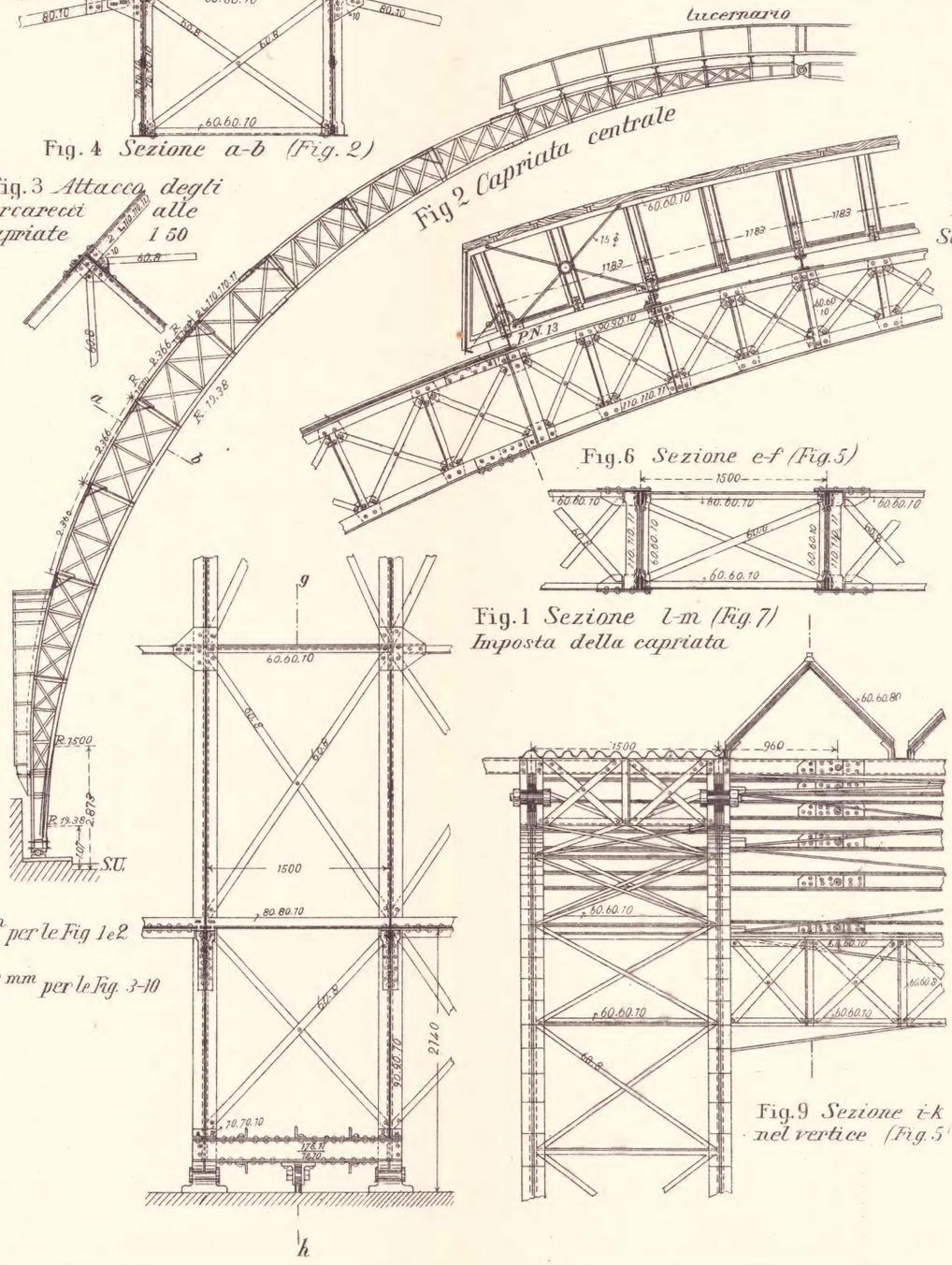


Fig. 6 *Sezione e-f (Fig. 5)*

Fig. 1 *Sezione l-m (Fig. 7)*
Imposta della capriata

Fig. 9 *Sezione i-k nel vertice (Fig. 5)*

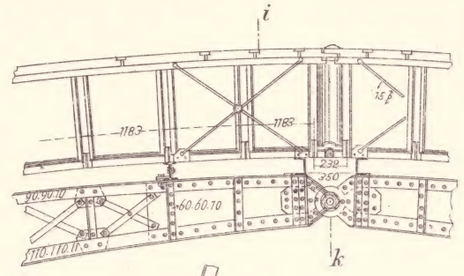


Fig. 5 *Vertice*
Sezione c-d (Fig. 9)

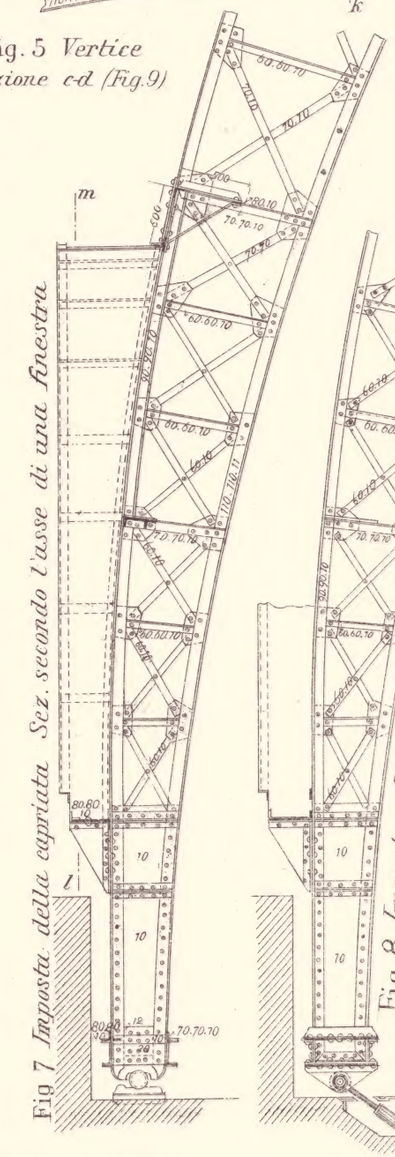


Fig. 7 *Imposta della capriata Sez. secondo l'asse di una finestra*

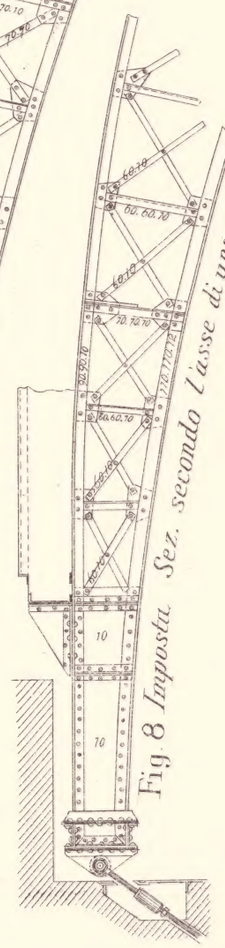


Fig. 8 *Imposta. Sez. secondo l'asse di una capriata*

Stabilimenti Riuniti d. Arti Grafiche MILANO

Tettoia della stazione della slesia a Berlino

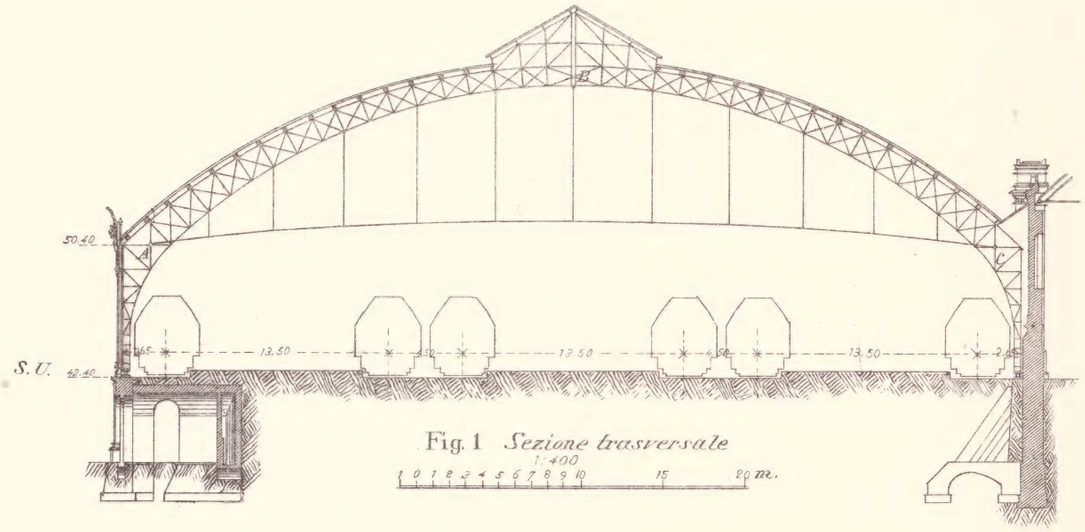


Fig. 1 *Sezione trasversale*
1:400
0 1 2 3 4 5 6 7 8 9 10 15 20 m.

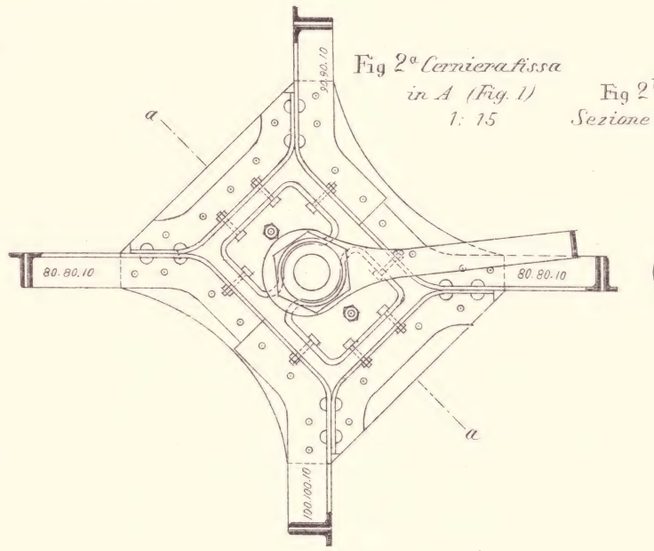


Fig 2ª *Cerniera fissa in A (Fig. 1)* 1:15

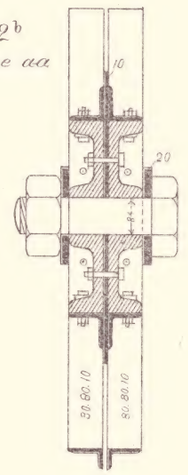
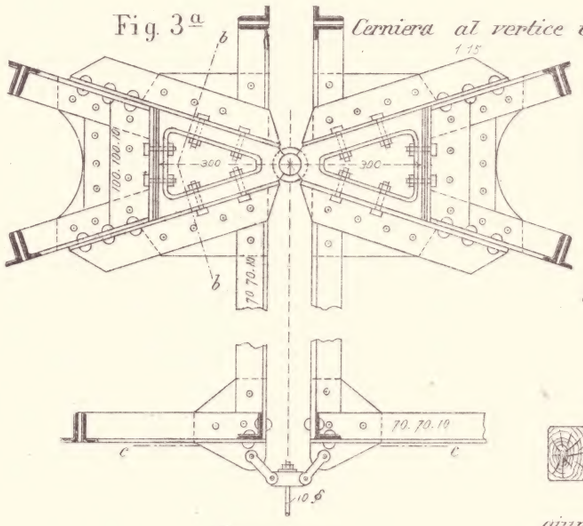


Fig 2ᵇ *Sezione aa*

Fig. 3ª *Cerniera al vertice in B* 1:15



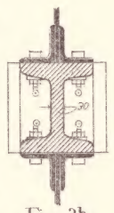


Fig. 3ᵇ *Sezione bb*

Sezione c-c

Fig. 3ᶜ

1:15
100 50 0 100 200 300 400 500 600 700 800 900 1000 mm.
per le fig. 2.3 e 4

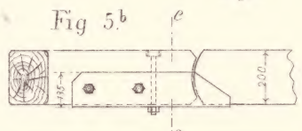
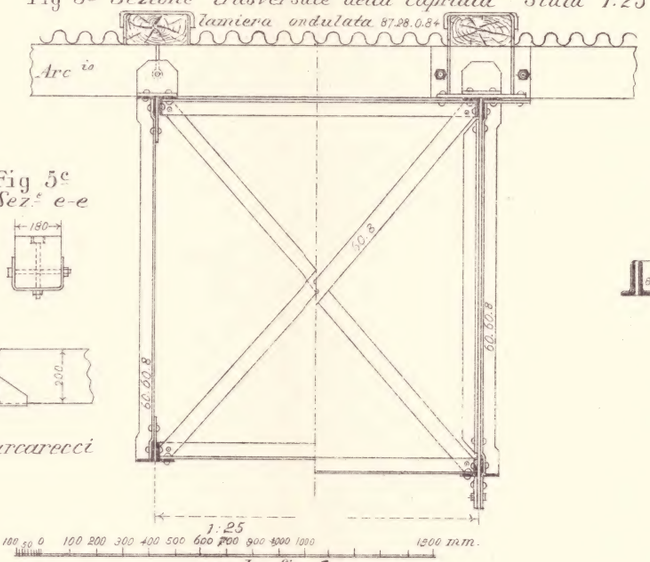


Fig. 5ᵇ

giunzione degli arcarecci

Fig. 5ᶜ *Sezᵗᵉ e-e*

Fig 5ª *Sezione trasversale della capriata Scala 1:25*



1:25
100 50 0 100 200 300 400 500 600 700 800 900 1000 1500 mm.
per la fig. 5.

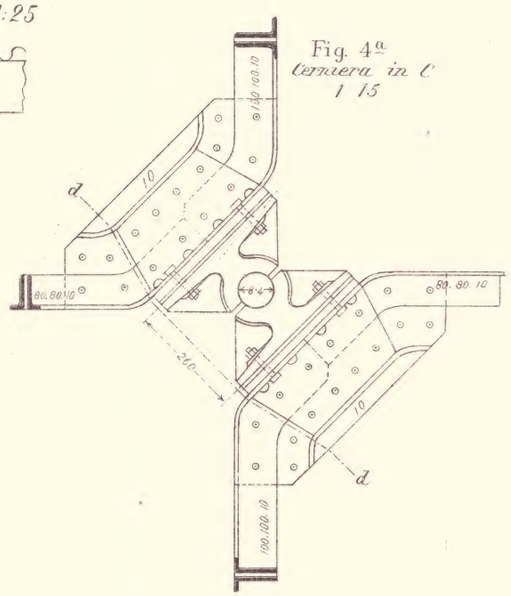


Fig. 4ª *Cerniera in C* 1:15

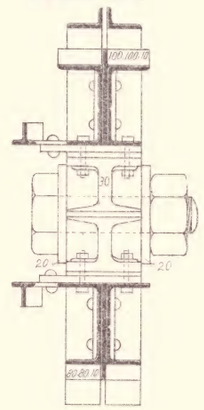


Fig. 4ᵇ *Sezione d-d*

Stabilimenti Riuniti d'Arti Grafiche MILANO

Tettoia della Stazione di Francoforte s. M.

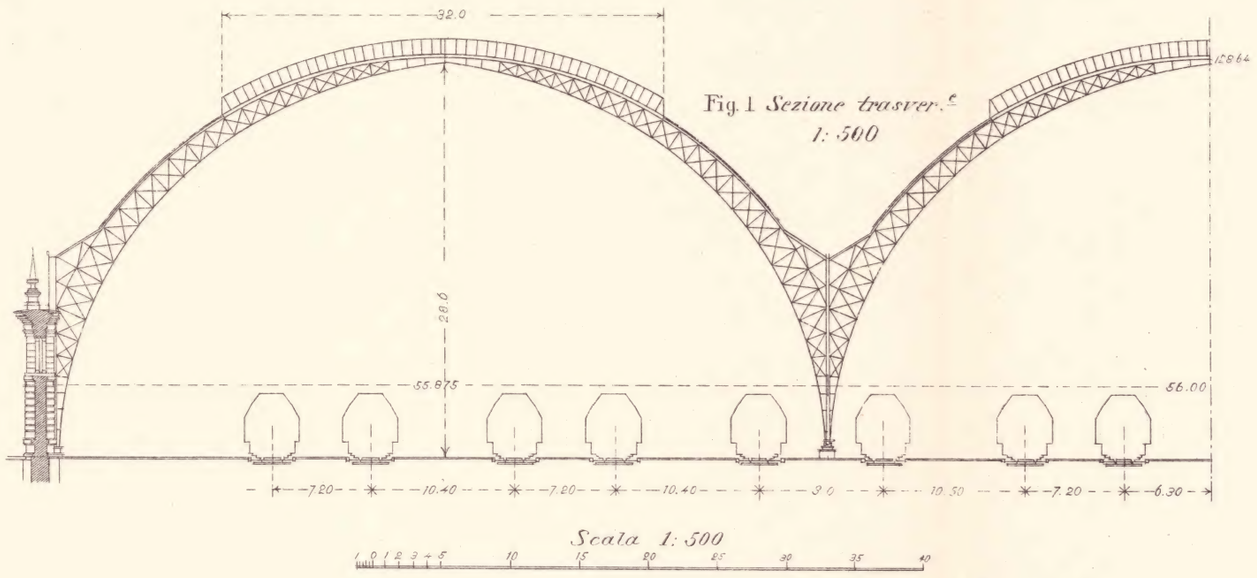


Fig. 1 *Sezione trasver.e* 1:500

Scala 1:500

Fig. 2b *Prospetto*

Fig. 2a *Pianta* 1:20

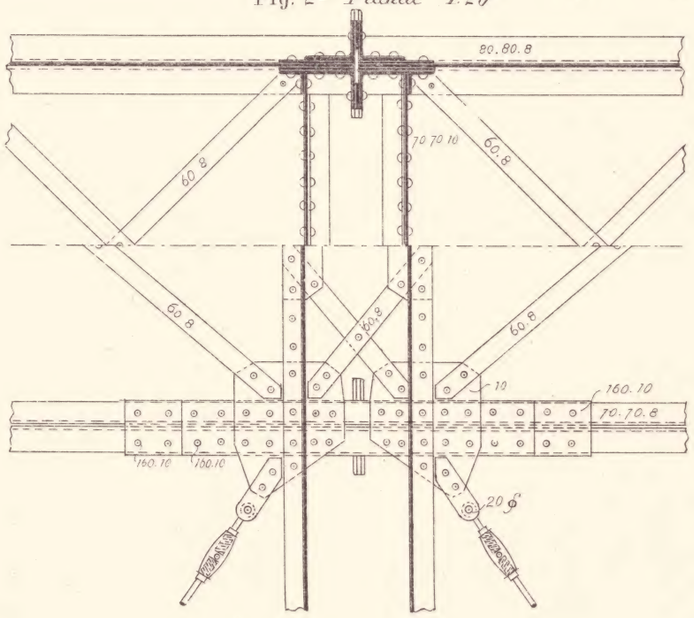


Fig. 2a-e *Cerniera al vertice* 1:15

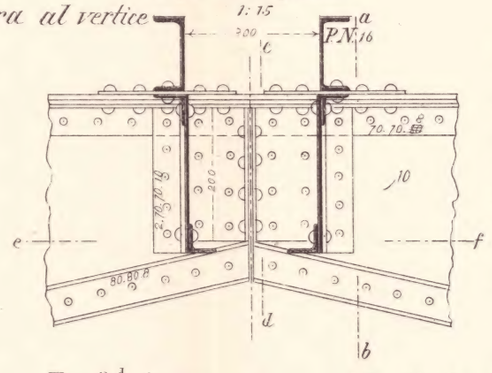


Fig. 2c *Sezione c-d* 1:15

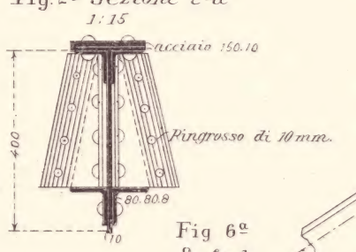


Fig. 2d *Sezione e-f* 1:15

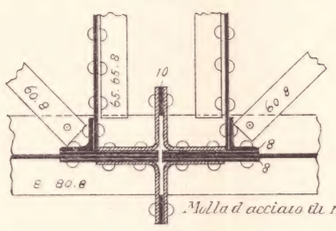


Fig. 2e *Sezione a-b* 1:15

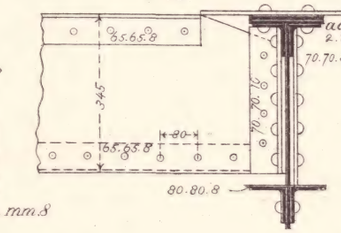


Fig. 3-6 *Gianzioni degli arcarecci* 1:10

Fig. 3a

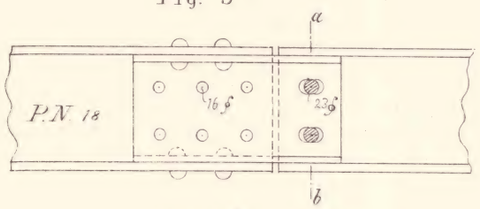


Fig. 3b *Sez.e a-b*

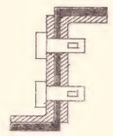


Fig. 4a

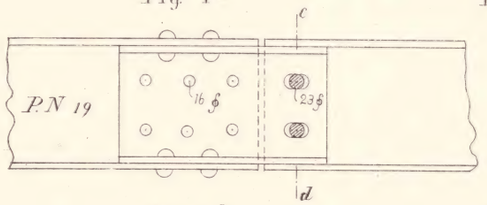


Fig. 4b *Sez.e c-d*

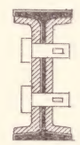


Fig. 5a

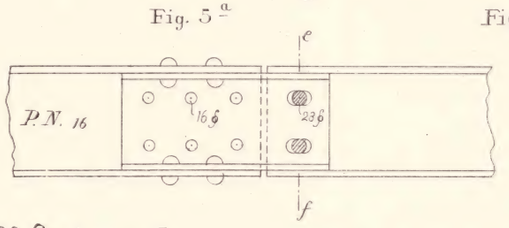


Fig. 5b *Sez.e e-f*

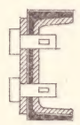


Fig. 6b

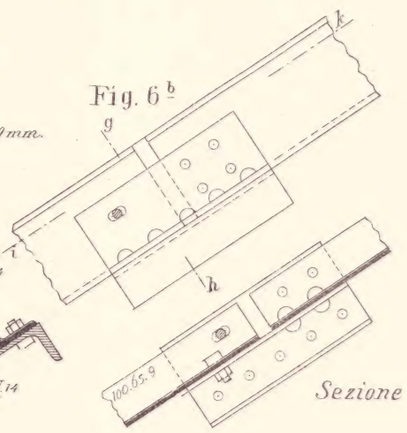
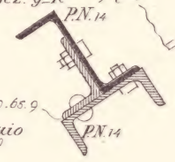


Fig. 6a *Sez.e g-h*



Sezione i-k

1:10 10 8 6 4 2 0 10 20 30 40 50 60 cm.

1:15 10 5 0 10 20 30 40 50 60 70 80 90 100 cm

1:20 10 5 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 cm.

Stabilimenti Riuniti d'Arti Grafiche MILANO

Tettoia del mercato di Hannover

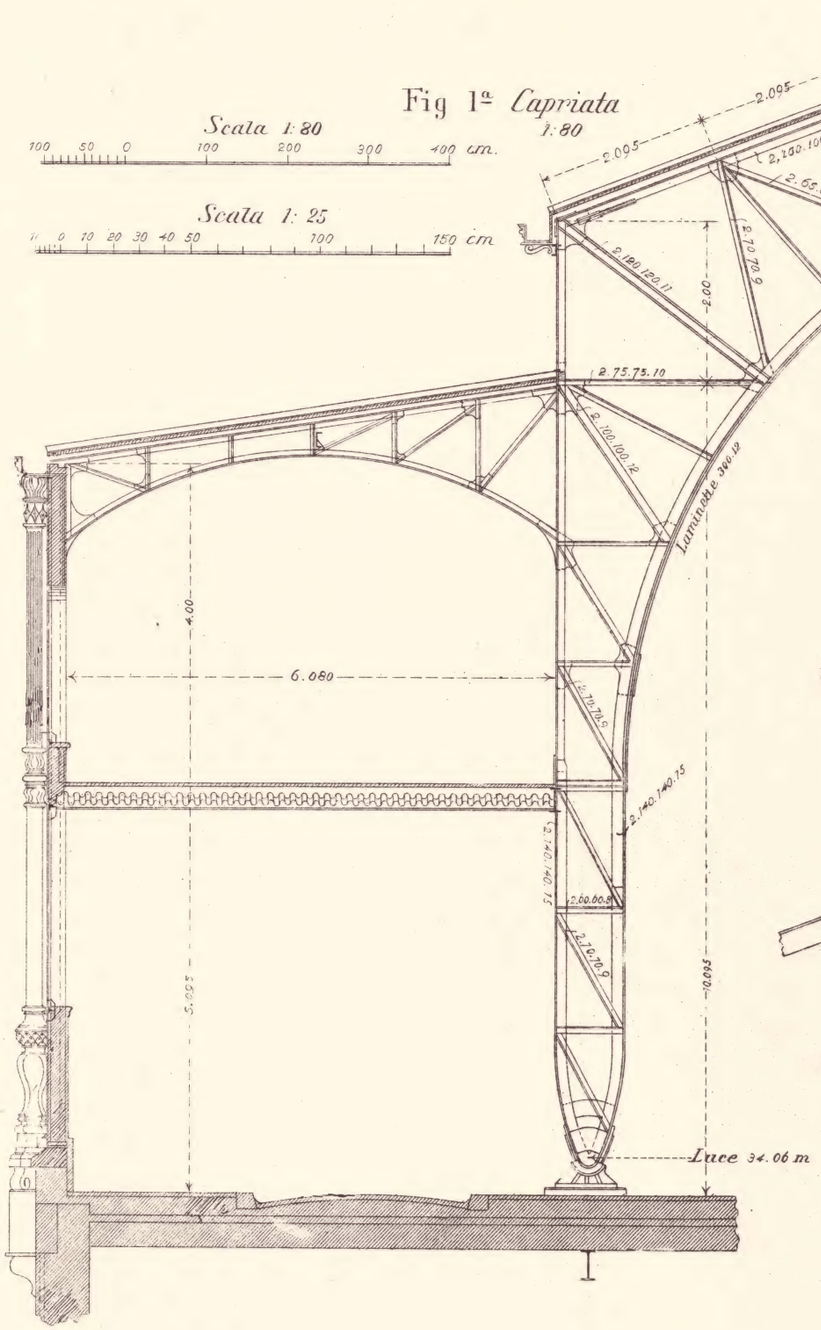
Fig 1ª *Capriata* 1:80

Scala 1:80

100 50 0 100 200 300 400 cm.

Scala 1:25

0 10 20 30 40 50 100 150 cm



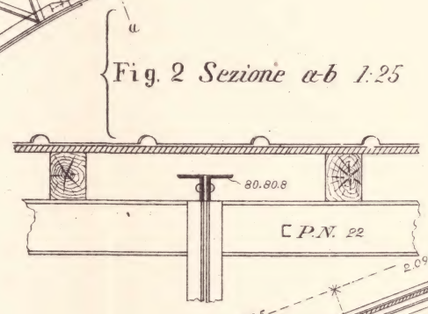


Fig. 2 *Sezione a-b 1:25*

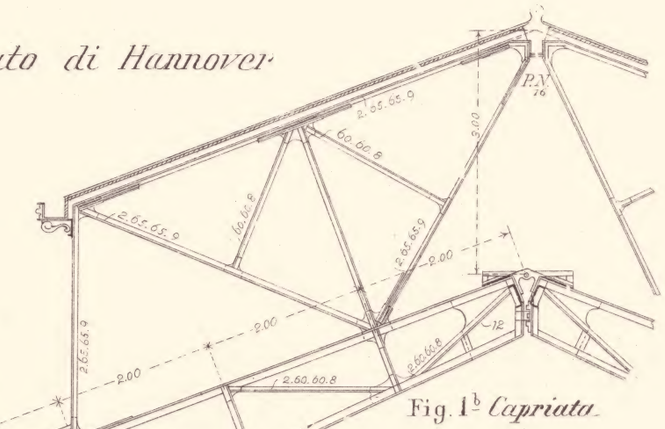


Fig. 1ᵇ *Capriata*

Fig. 4 Piede della capriata Scª 1:25

Fig. 4ª *Elevaz.ne*

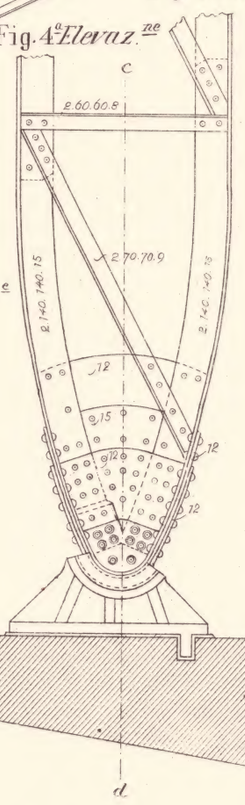
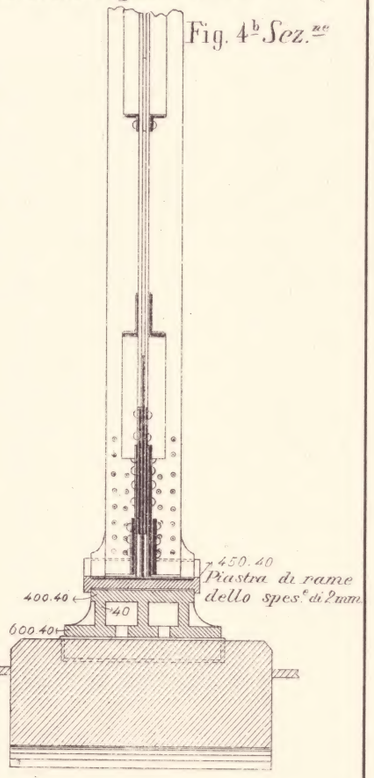


Fig. 4ᵇ *Sez.ne*



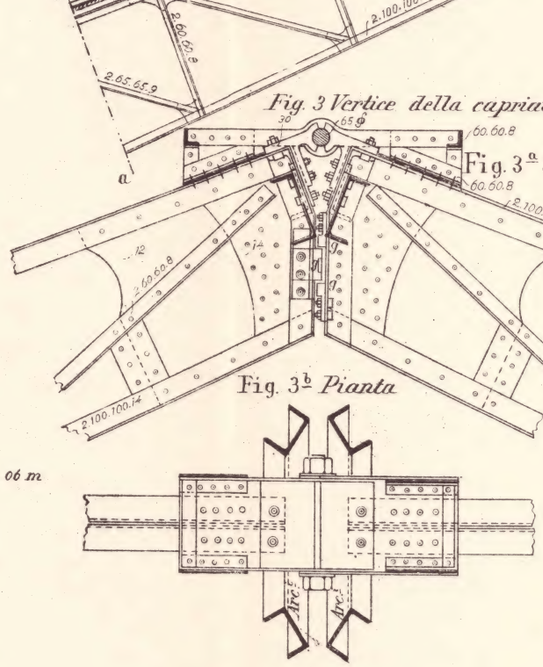


Fig. 3ª *Sezᵉ Trasverᵉ*

Fig. 3ᵇ *Pianta*

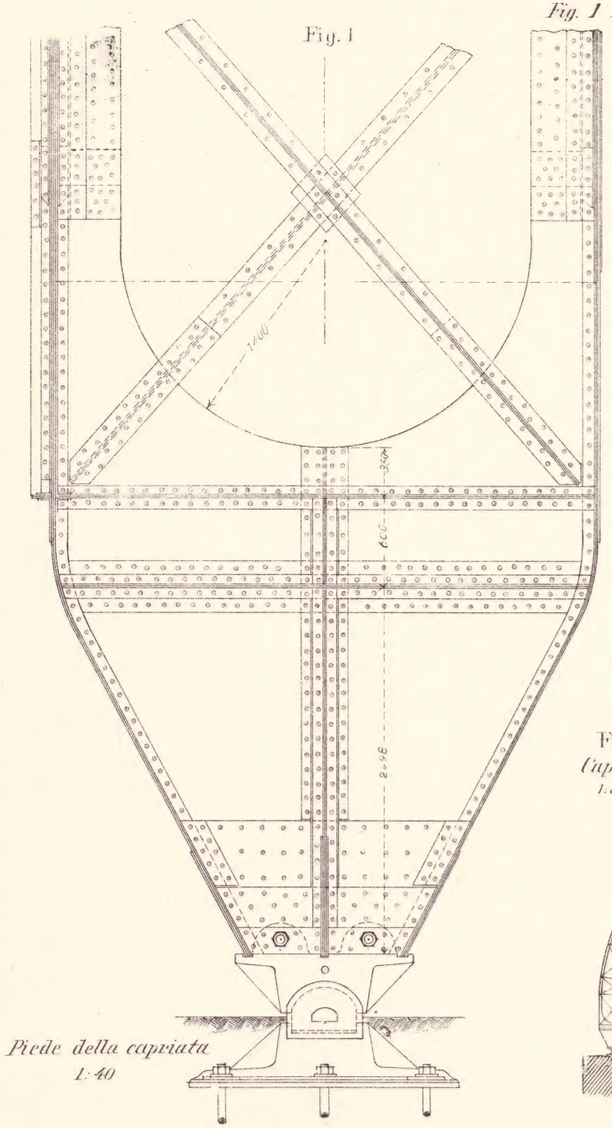
Stabilimenti Riuniti d'Arti Grafiche MILANO

Cerniere delle travi ad arco

del locale

Fig. 1 Fig 4 Tettoia delle macchine Esposizione di Parigi 1889

Fig. 1



Piede della capriata
1:40

Fig. 2ª *Sezione a-b*
1:25

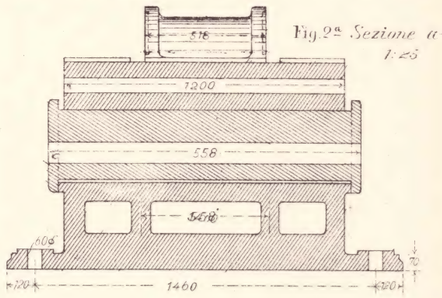


Fig. 2ᵇ
Pianta della parte superiore
1:95

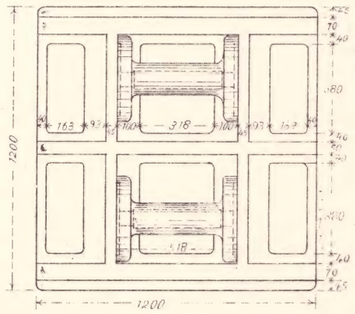
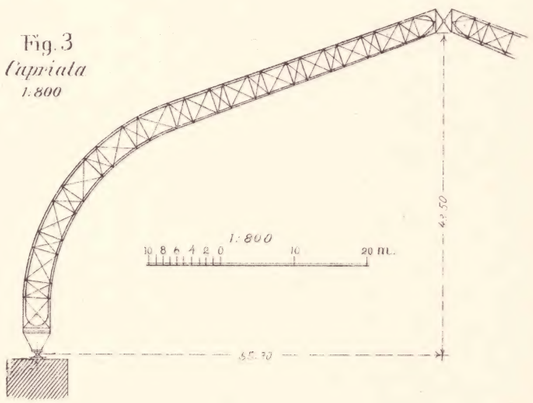
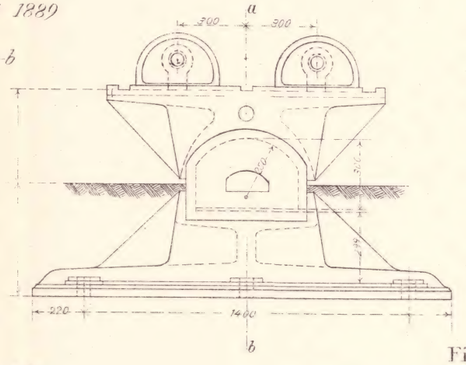


Fig. 3
Capriata
1:800





Fondazione del piede della capriata
Fig 4
1:200

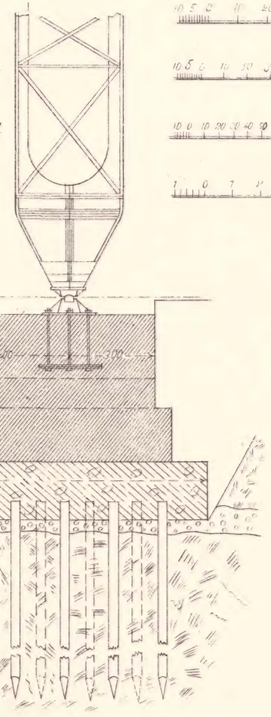


Fig. 5 e 6 *Appoggio della tettoia della stazione di Harmorer*
1:20

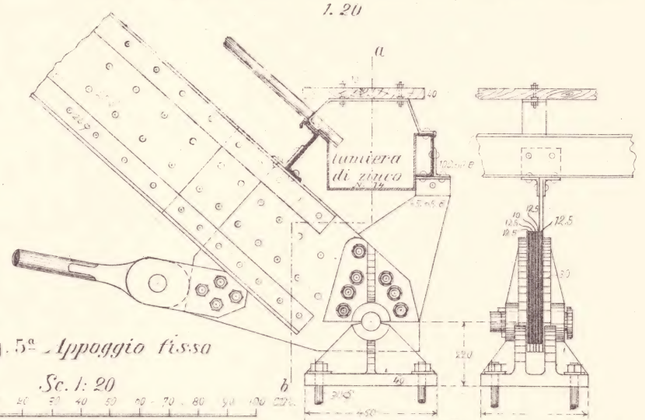


Fig. 5ª *Appoggio fisso*

Fig. 5ᵇ *Sez. c-d*

Sc. 1:20

Sc. 1:25

Sc. 1:40

Sc. 1:200

Fig. 6ª
Appoggio a rulli

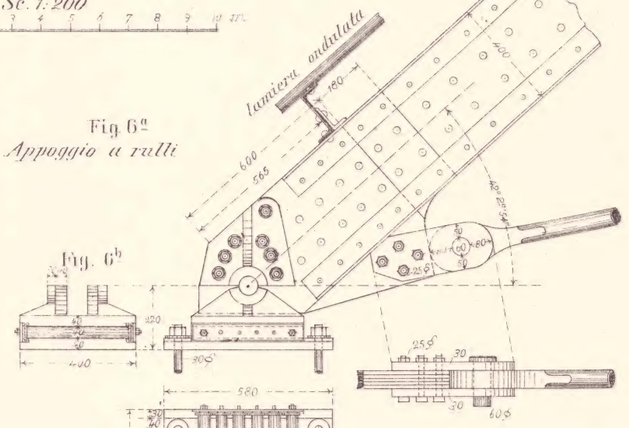


Fig. 6ᵇ

Fig 6ᶜ

Fig. 6ᵈ *Tirante*

Stabilimenti Riuniti d'Arti Grafiche MILANO

Cerniere delle travi ad arco

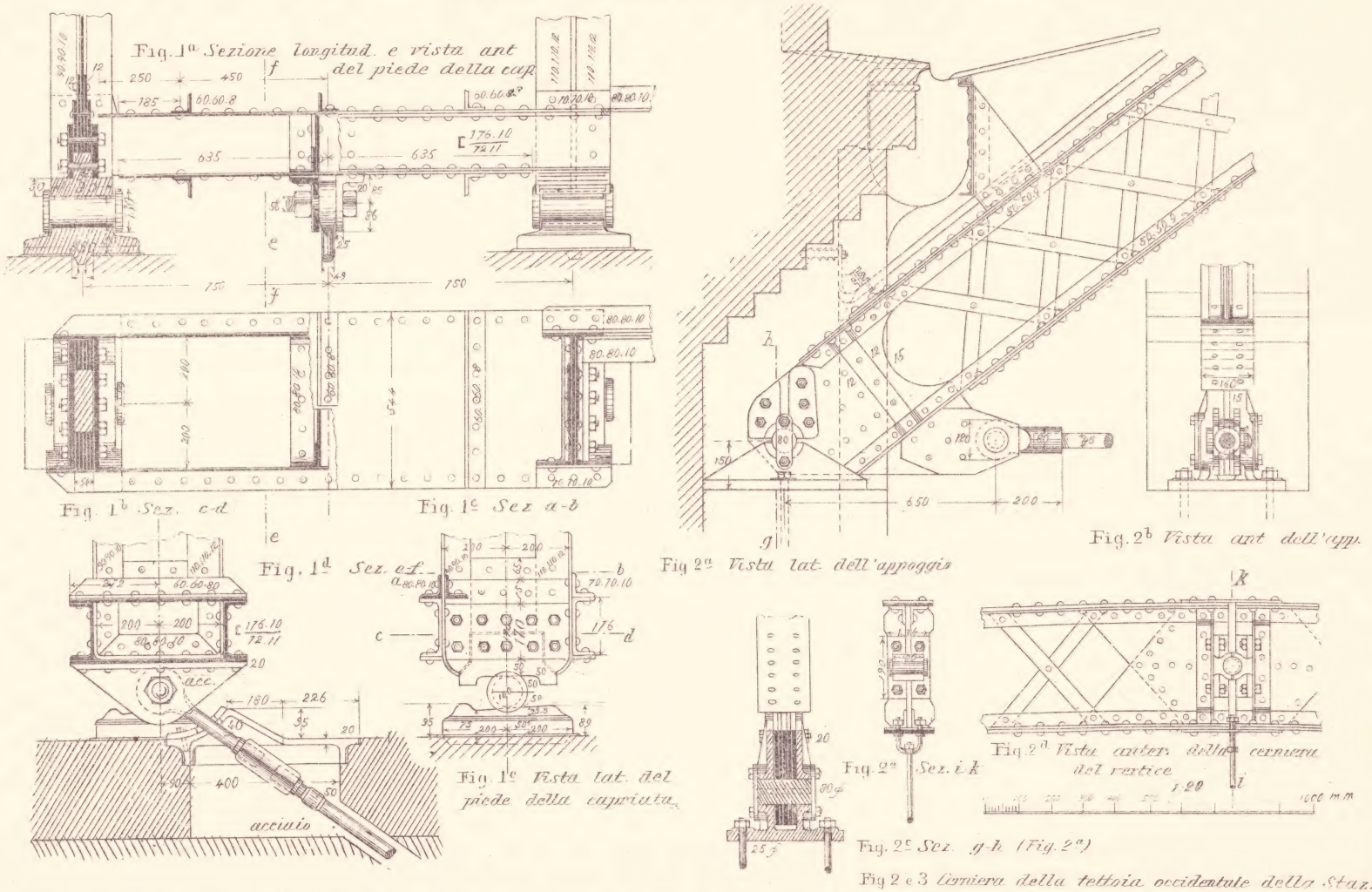


Fig. 1 Cerniera d'imposta delle capriate nella tettoia della Staz. nella Alexanderplatz a Berlino

Fig 2 e 3 Cerniera della tettoia occidentale della Staz. centr. di Magdeburgo

Stabilimenti Riuniti d'Arti Grafiche MILANO

Cerniere delle travi ad arco

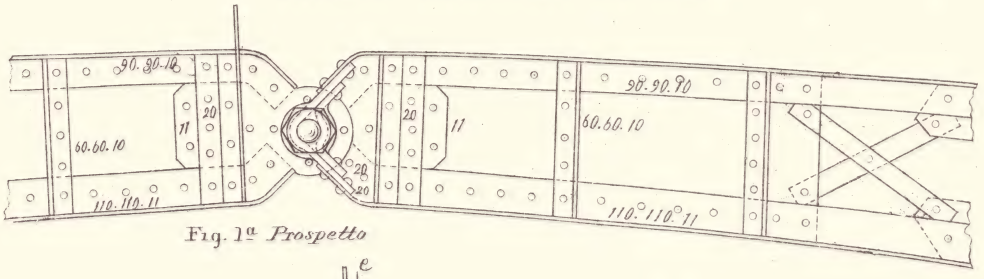


Fig. 1a Prospetto

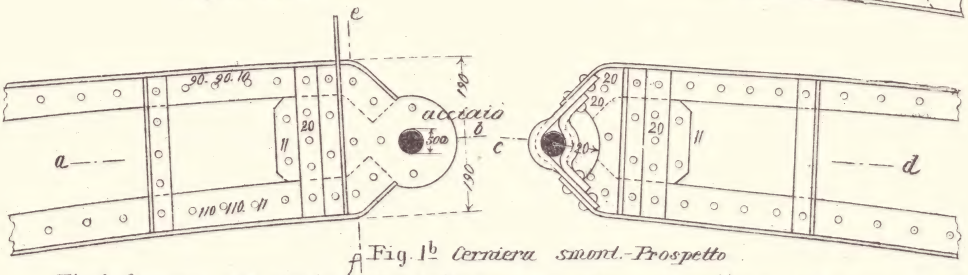


Fig. 1b Cerniera smont.-Prospetto

Fig 1 Cerniera del vertice nella tettoia della Staz. nella Alexanderplatz a Berlino

Fig. 1c Sez. a-b

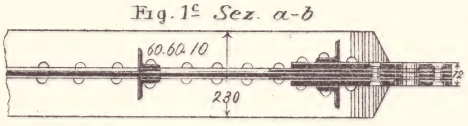
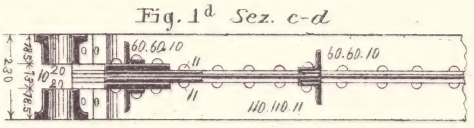


Fig. 1d Sez. c-d



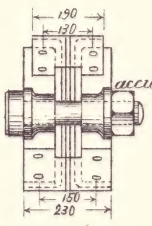


Fig. 1e Vista ant.
(Fig. 1b)

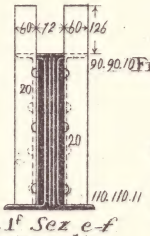


Fig. 1f Sez e-f
(Fig 1c)

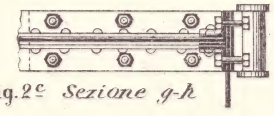


Fig. 2c Sezione g-h

Fig. 2

Cerniera del vertice nella tettoia della Staz. dell' Est a Berlino

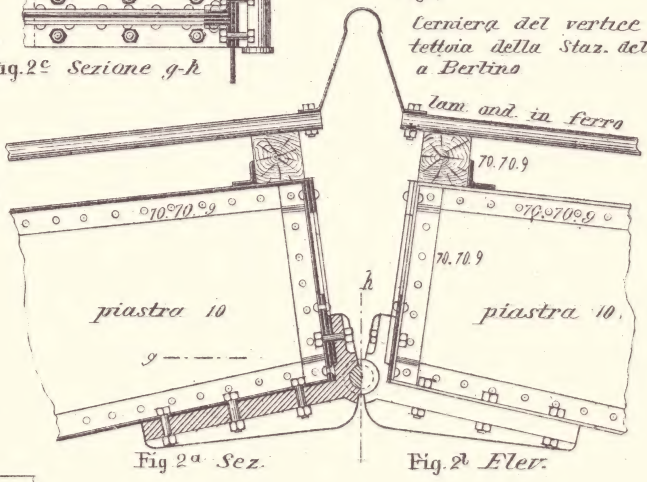


Fig. 2a Sez.

Fig. 2b Elev.

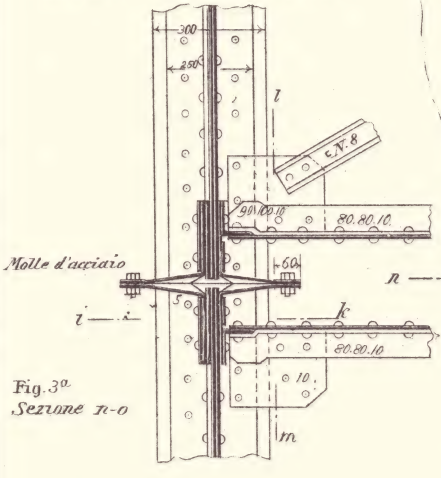


Fig. 3a
Sezione n-o

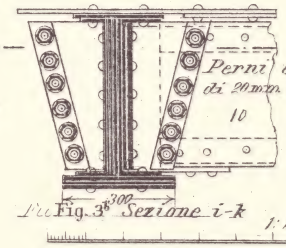


Fig. 3b Sezione i-k

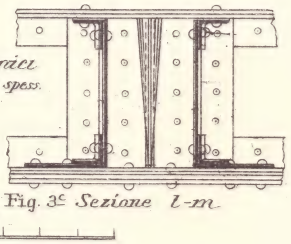


Fig. 3c Sezione l-m

1:20

Fig. 3 Cerniera del vertice nei ponti ad arco della ferrovia Metropolitana di Berlino

Stabilimenti Riuniti d'Arti Grafiche MILANO

Solai 1

Fig. 1a

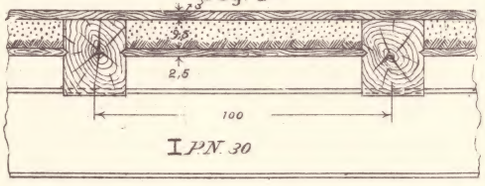


Fig. 1b

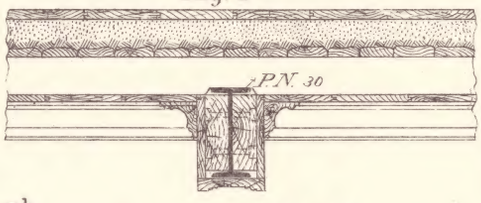


Fig. 2a

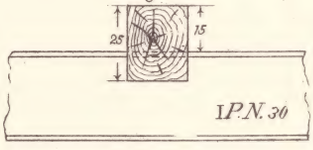


Fig. 2b

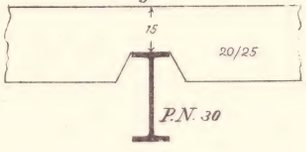


Fig 3a

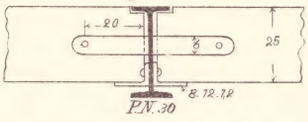


Fig. 3b

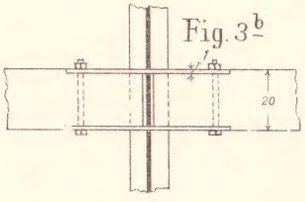


Fig. 4a

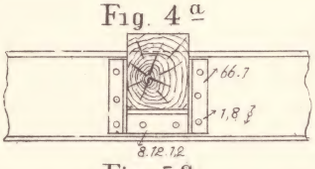


Fig 4b

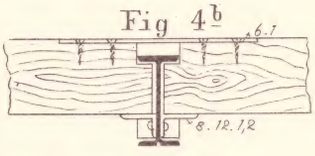


Fig 5a

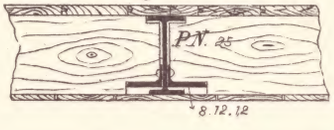


Fig 5b

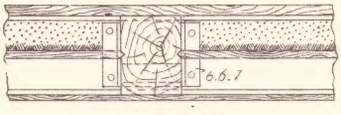


Fig. 6

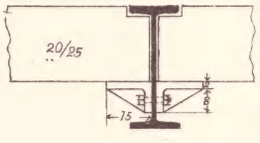


Fig 7a

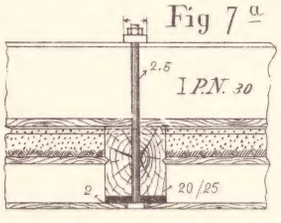


Fig 7b

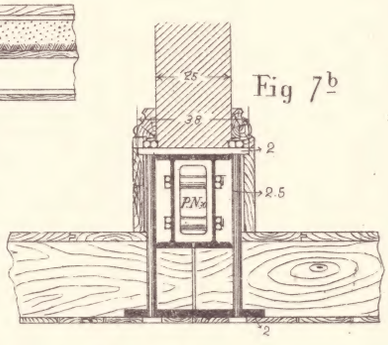


Fig. 8a

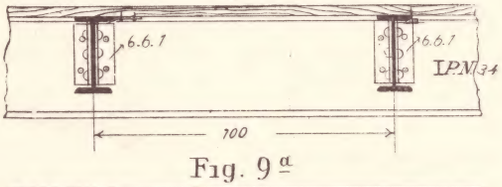


Fig. 8b

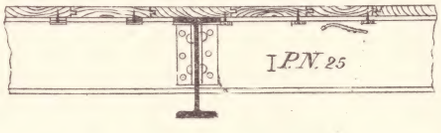


Fig. 9a

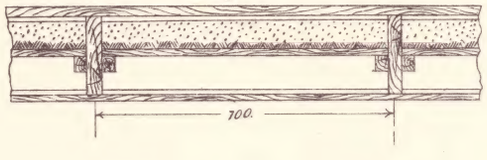


Fig 9b

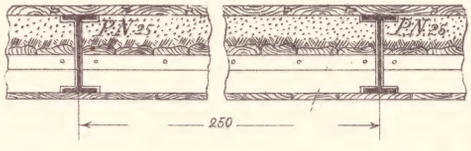


Fig. 10a

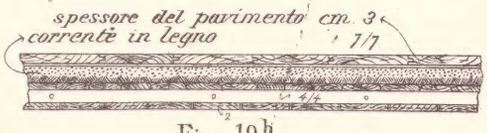
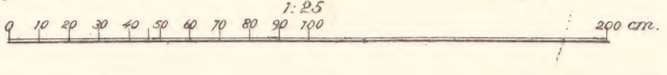


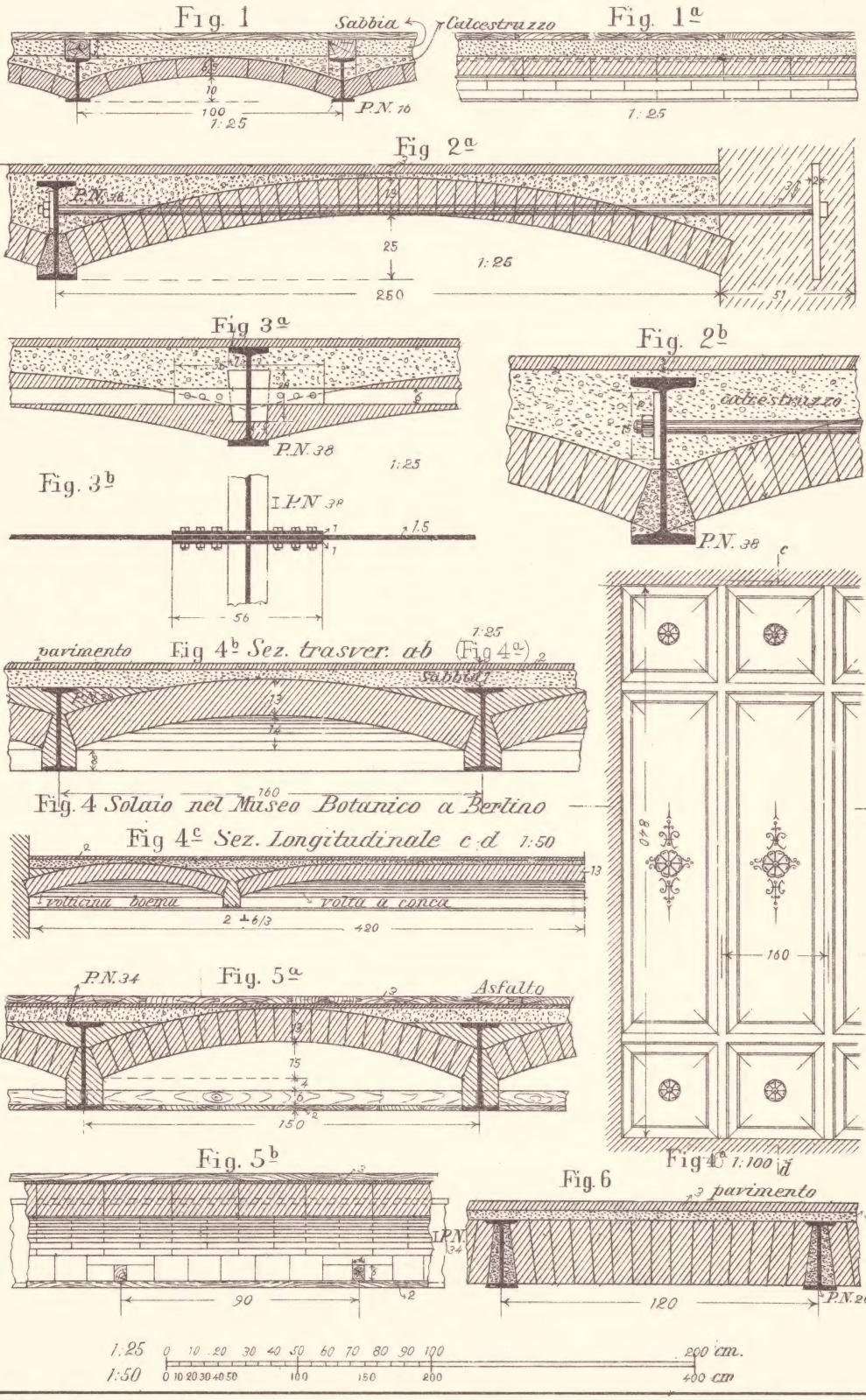
Fig. 10b



Breymann III

Stabilimenti Riuniti d'Arti Grafiche - MILANO

Solai 2



Stabilimenti Riuniti d'Arti Grafiche - MILANO

Soldi 3

Fig. 1ª 1:25

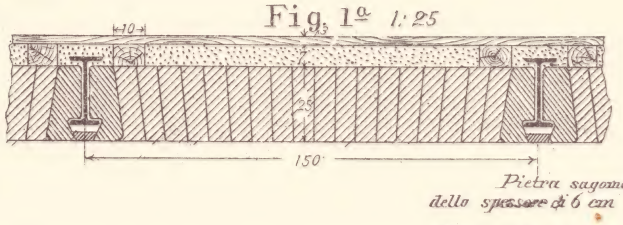


Fig. 1ᵇ 1:15

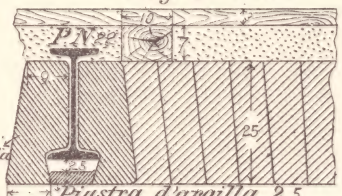


Fig. 2ª 1:25

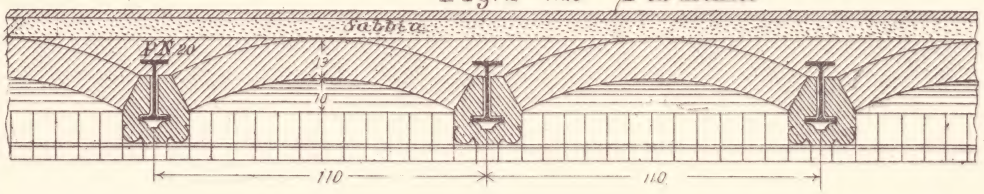


Fig. 2ᵇ 1:25

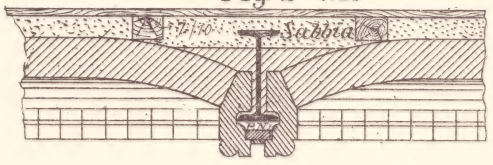


Fig. 2ᶜ 1:25

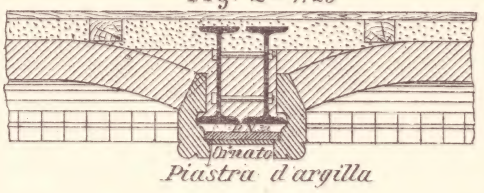


Fig. 3 1:25

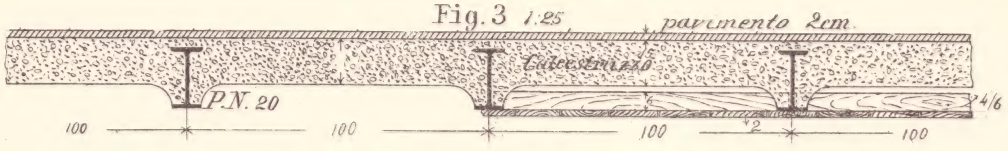


Fig. 4 1:25

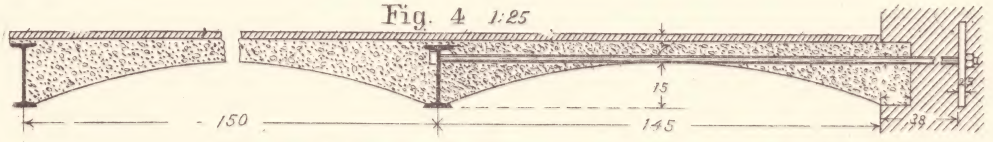


Fig. 5ª 1:25

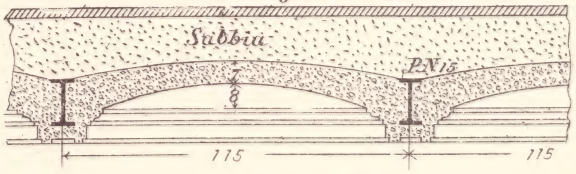


Fig. 5ᵈ

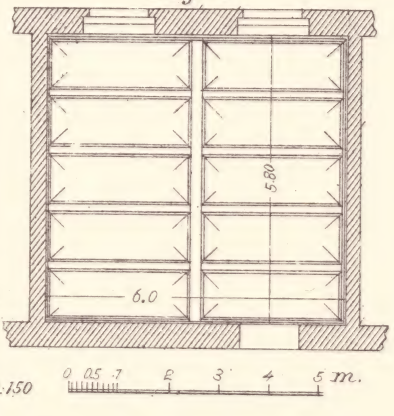


Fig. 5ᵇ

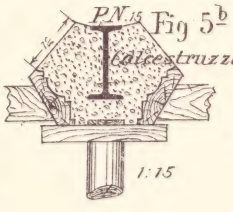


Fig. 5ᶜ

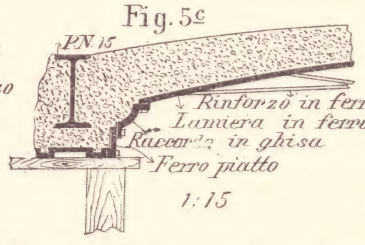


Fig. 5 Solaio nel palazzo di giustizia a Francoforte S.M.

1:15 0 10 20 30 40 50 cm.

1:25 0 10 20 30 40 50 60 70 80 90 100 cm.

Stabilimenti Riuniti d'Arti Grafiche MILANO

Solai

Fig. 1 *Volticino in calcestruzzo*

Fig. 2

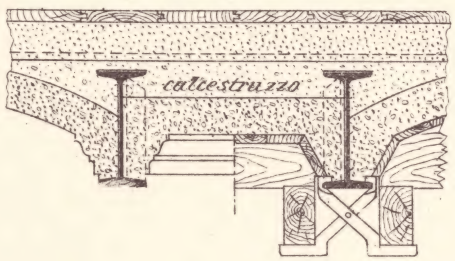


Fig. 3

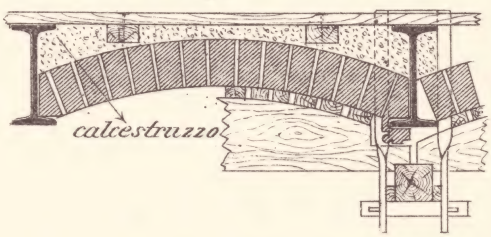


Fig. 4

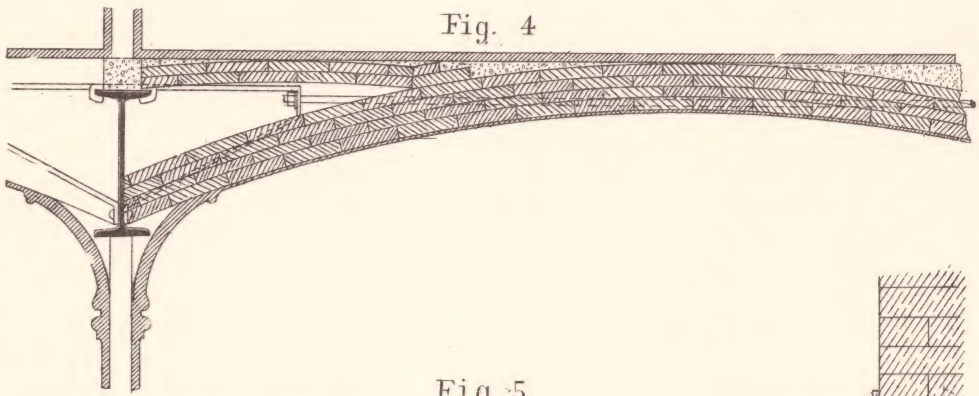
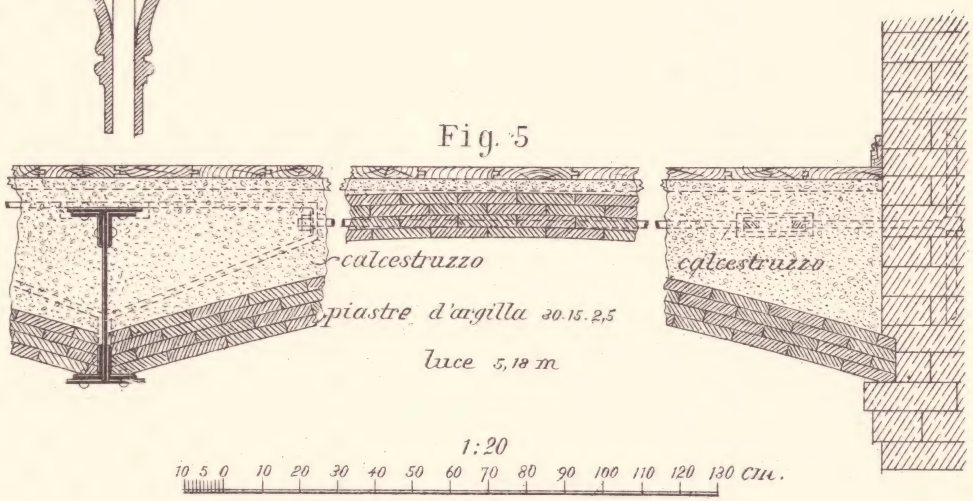


Fig. 5



Stabilimenti Riuniti d'Arti Grafiche - MILANO

Solaio con volta sistema Rabitz

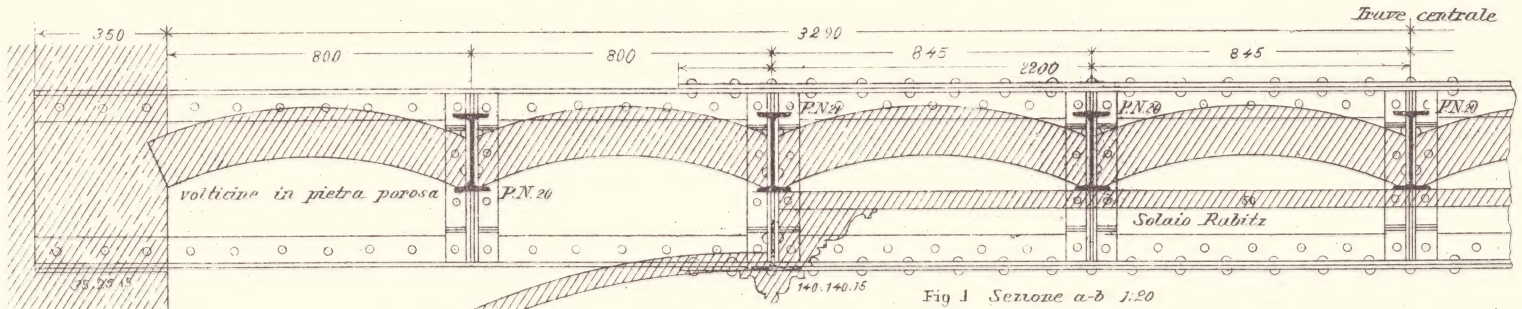


Fig 1 Sezione a-b 1:20

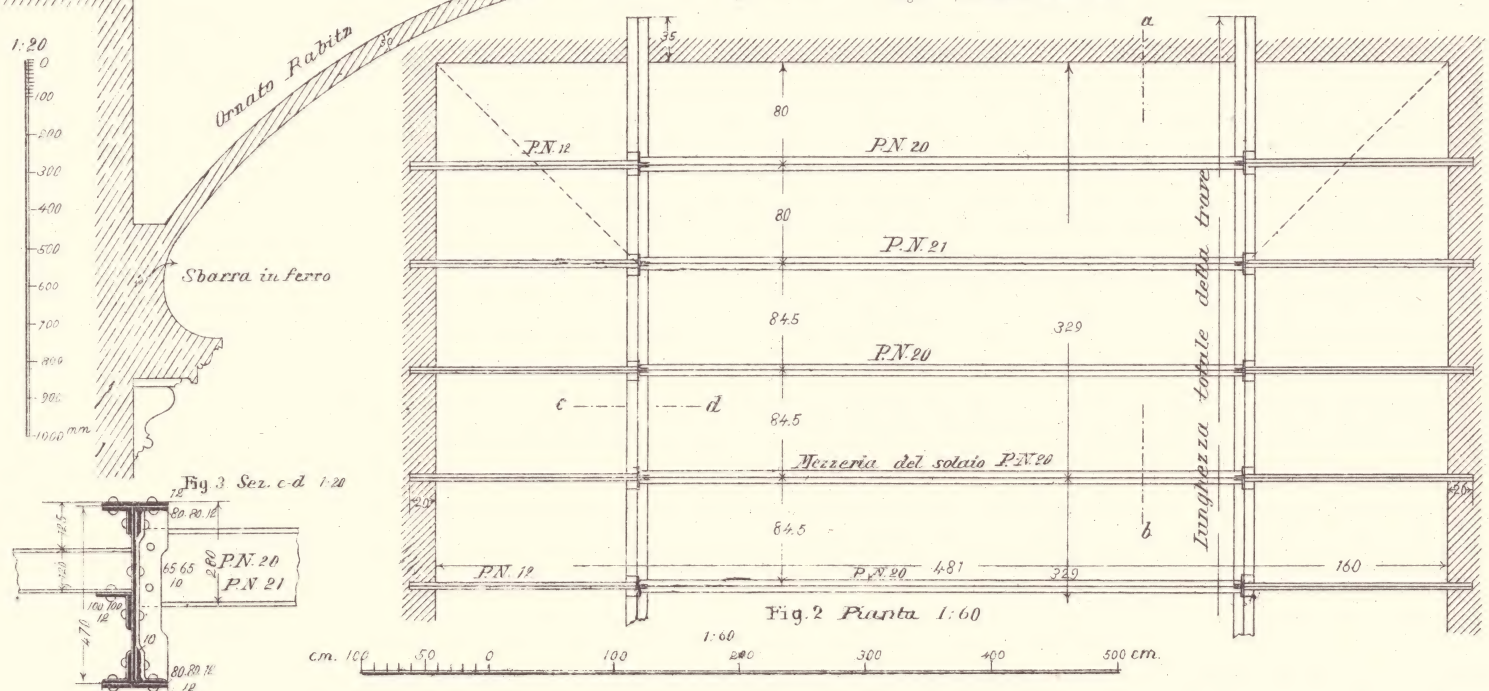


Fig. 2 Pianta 1:60

Fig. 3 Sez. c-d 1:20

Stabilimenti Riuniti Arti grafiche MILANO

Solai sistema Klein

Fig. 1 *Vista di sopra*

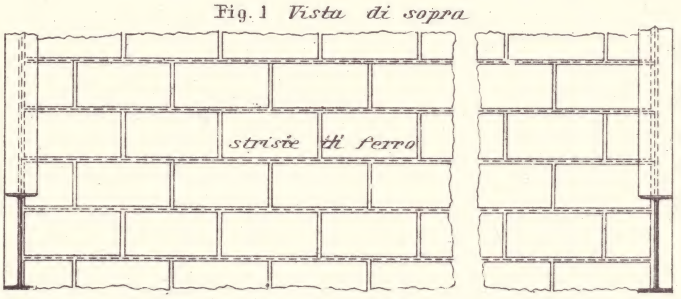


Fig. 2[b]
Appoggio

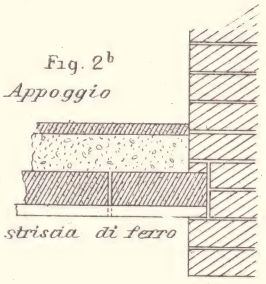


Fig. 2[a] *Sez. trasver.*

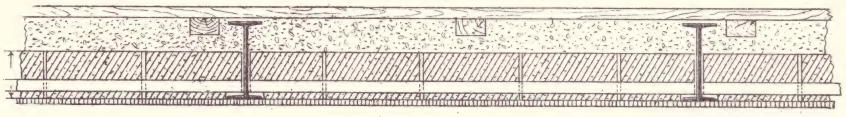
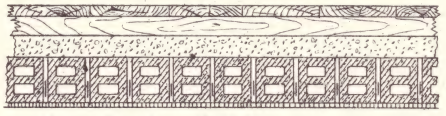
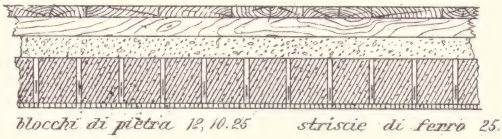


Fig. 3[a] *Sez. longitud*



mattoni forati 12. 10. 25

Fig. 3[b] *Sez.. longitud.*



blocchi di pietra 12, 10. 25 striscie di ferro 25.1

Fig. 4[a]
Seziane trasversale

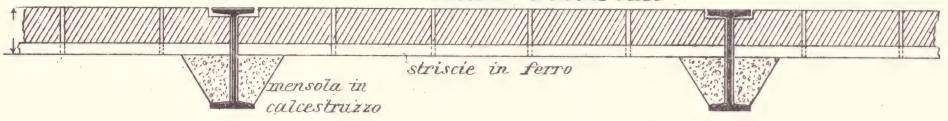


Fig. 4[b]
Sezione trasversale

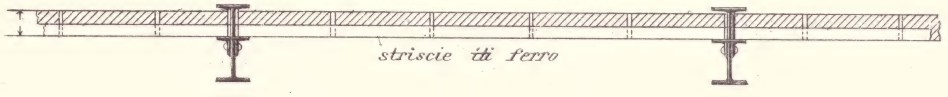
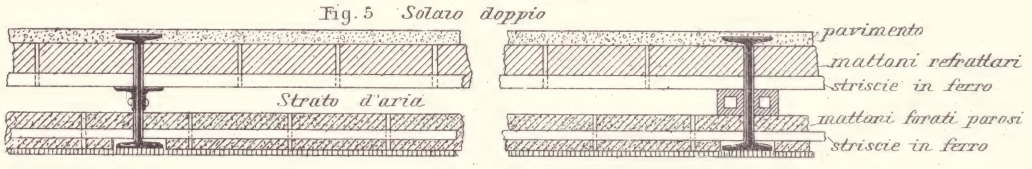
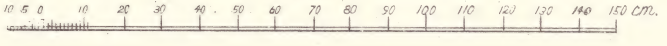


Fig. 5 *Solaio doppio*



1:20



Breymann III

Stabilimenti Riuniti d'Arti Grafiche MILANO

Solai

Fig. 1 *Fig. 1 e 2 Solaio con pietre Monier* Fig. 2

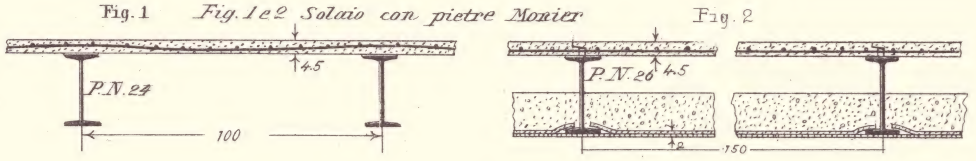


Fig. 3 e 5 Solai a volta sistema Koenen

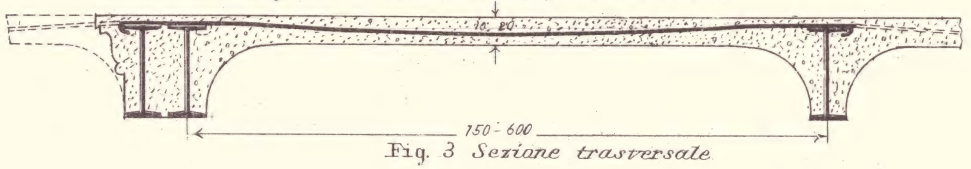


Fig. 3 *Sezione trasversale*

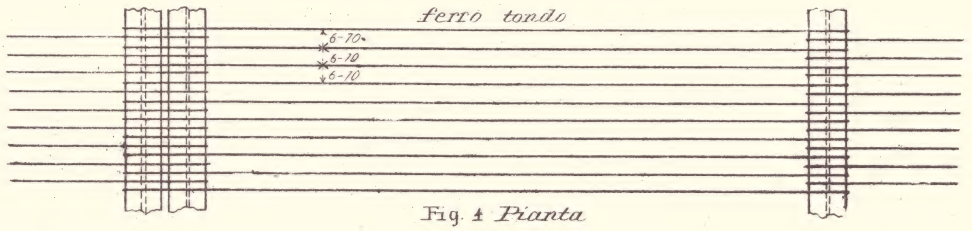


Fig. 4 *Pianta*

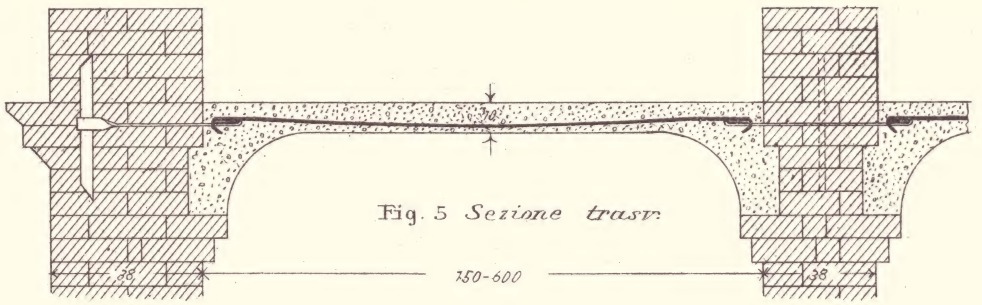


Fig. 5 *Sezione trasv.*

Fig. 6 *Solai sistema Stolte*

Fig. 6a *Sez. trasver.*

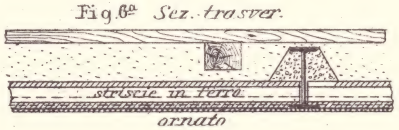
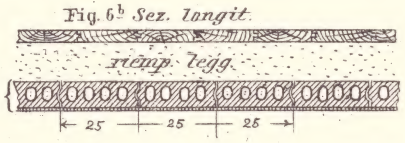


Fig. 6b *Sez. longit.*



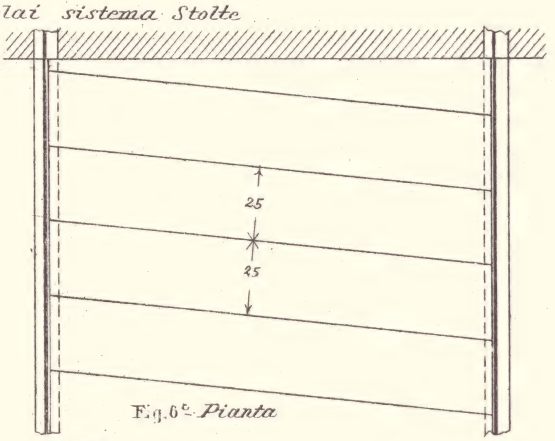
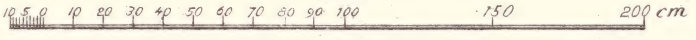


Fig. 6c *Pianta*

1:25



Stabilimenti Riuniti d'Arti Grafiche MILANO

Solai

Fig. 1 Sezione longitud

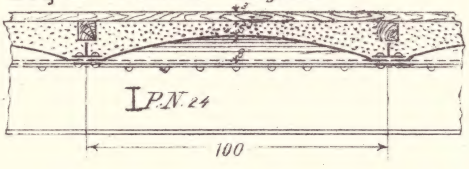
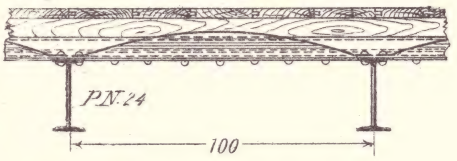


Fig 1ª Seziane trasvers.



concave

Solaio con lamiere

Fig 2 Seziane trasver.

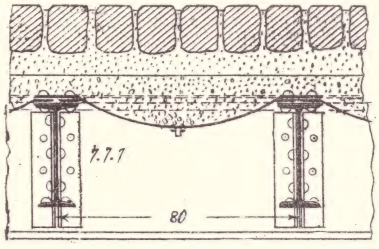
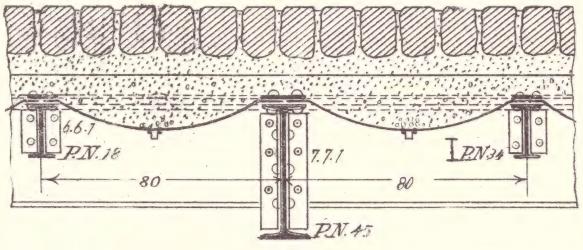


Fig 2ª Seziane longitud.



Solai con lamiere convesse

Fig 3 Seziane trasvers.

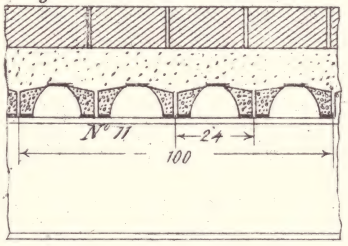
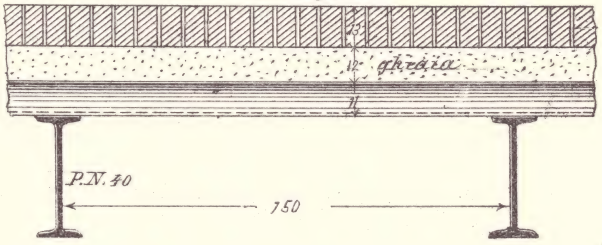


Fig 3ª Seziane longitud



Solaio con terri speciali

Fig. 4 Seziane trasver.

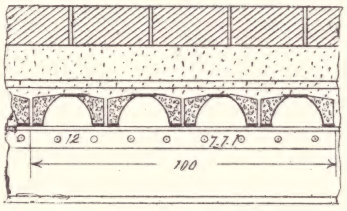
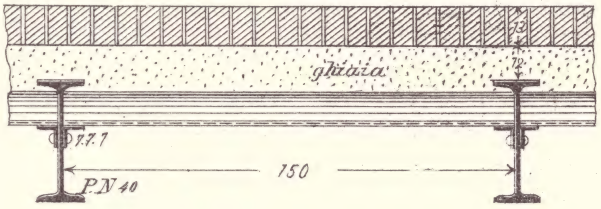


Fig 4ª Seziane longitud



Solai con terri speciali

Fig. 5 Sezione trasver.

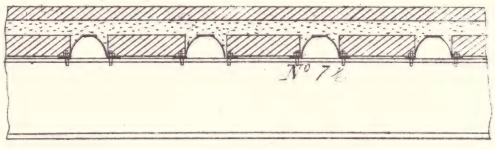


Fig 5ª Elevaziane

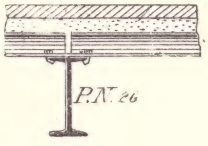
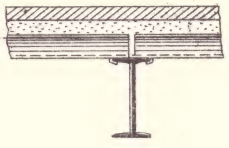
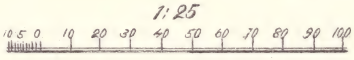


Fig. 5ᵇ Seziane



1:25



Stabilimenti Riuniti d'Arti Grafiche MILANO

Pareti a traliccio in ferro

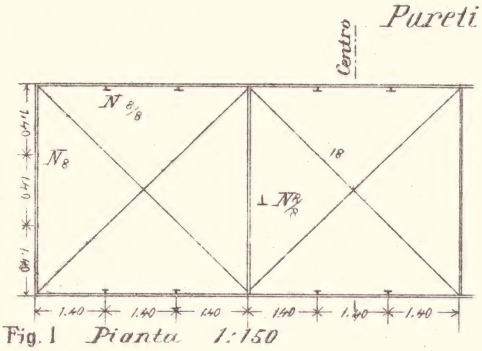


Fig. 1 Pianta 1:150

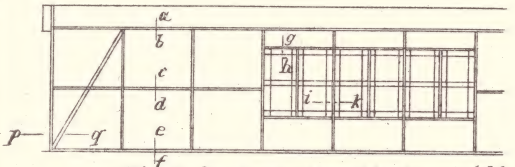


Fig. 2 Sezione longitud. 1:150

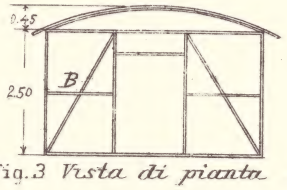


Fig. 3 Vista di pianta 1:150

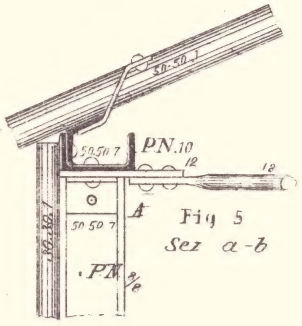


Fig 5 Sez a-b

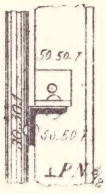


Fig 6 Sez. c-d

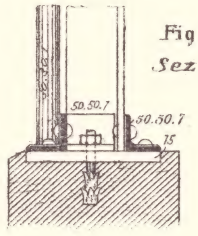


Fig 7 Sez. e f

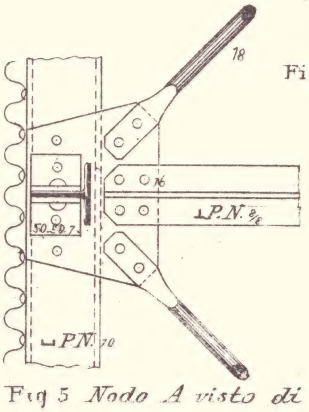


Fig 5 Nodo A visto di sotto

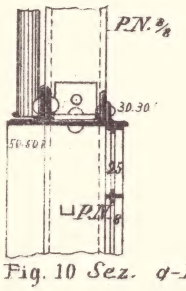


Fig. 10 Sez. g-h

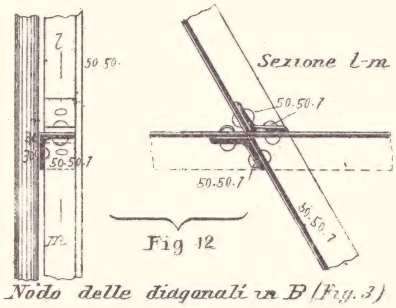


Fig 12

Nodo delle diagonali in B (Fig. 3)

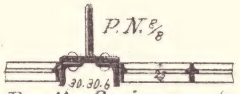
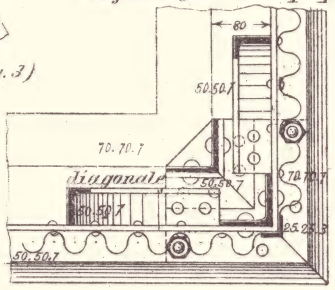


Fig. 11 Sezione i-k

Fig. 13 Angolo Sez. p-q



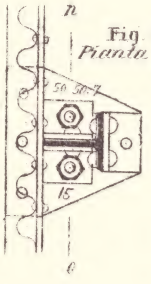


Fig. 8 Pianta nella sez. e-f

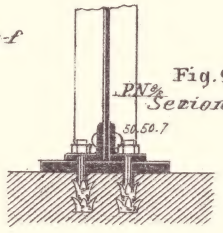


Fig. 9 Sezione n-o

1:150 1 0.5 0 1 2 3 4 5 m

1:10 0 20 40 60 80 100 200 300 400 500 m.m

Stabilimenti Riuniti d'Arti Grafiche MILANO

Balcone

Fig. 3 Sezione trasversale 1:25

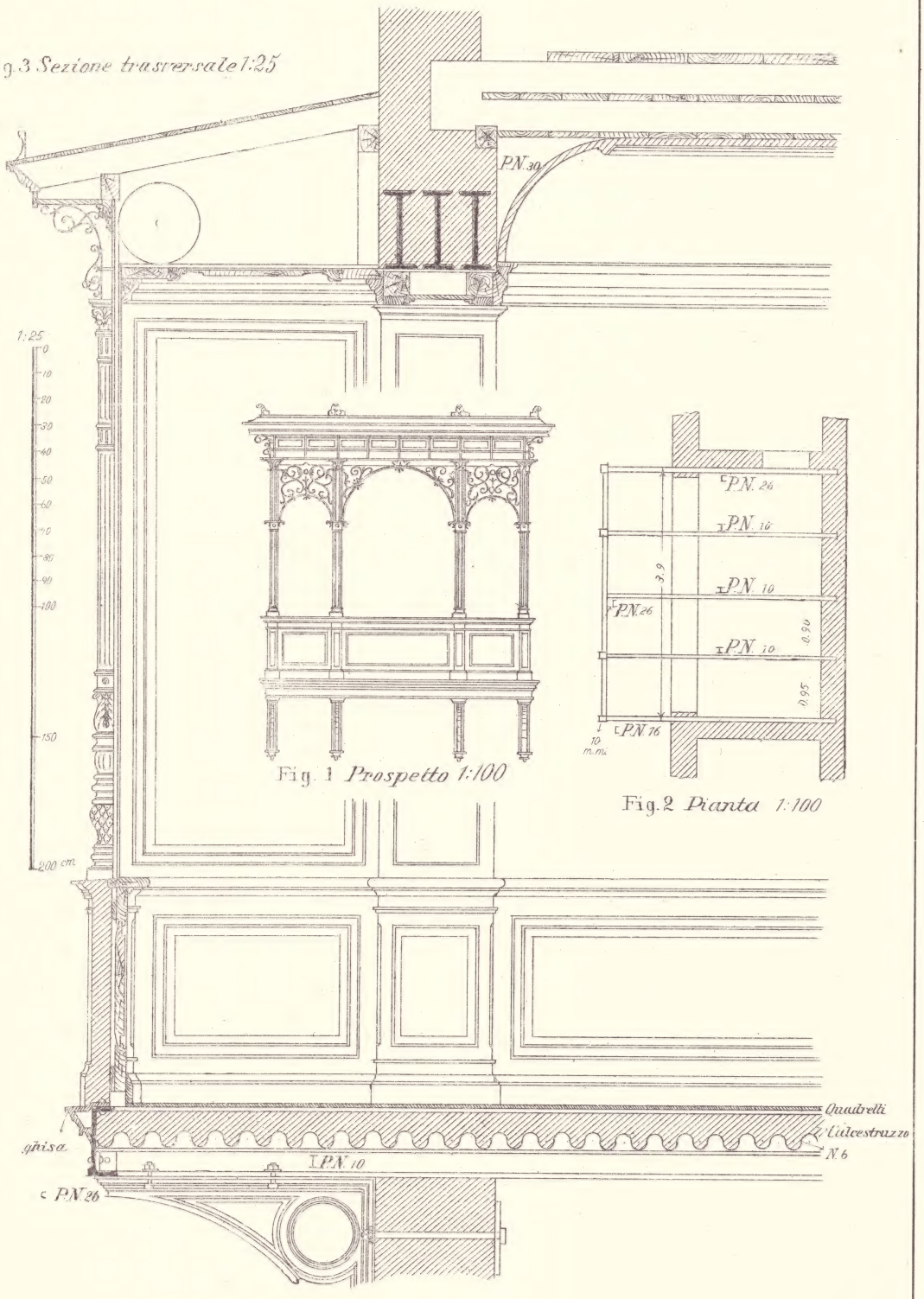


Fig. 1 Prospetto 1:100

Fig. 2 Pianta 1:100

Casa di ab. in Hallee sulla Sala

Stabilimenti Riuniti d'Arti Grafiche MILANO

Fig. 1.

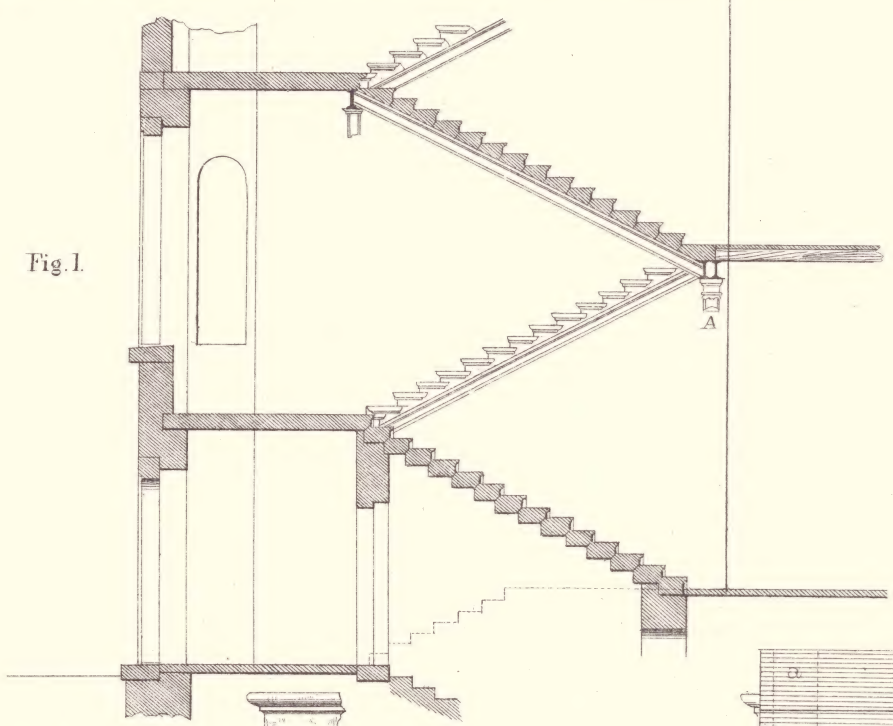


Fig. 3.

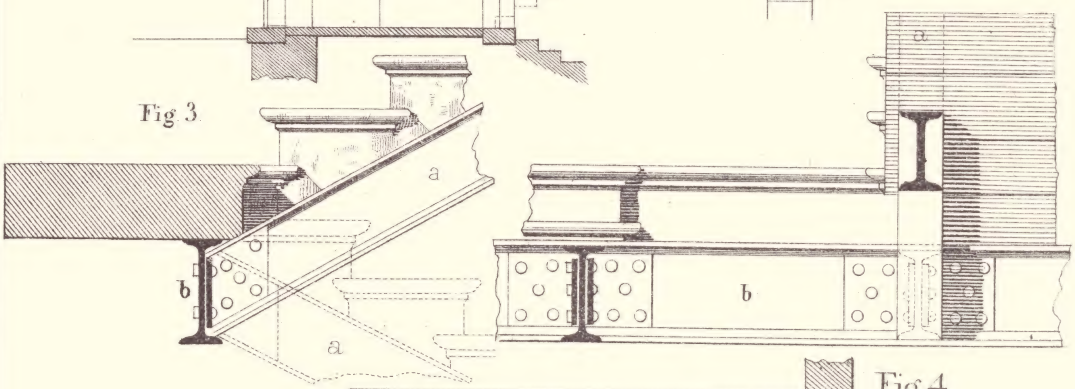
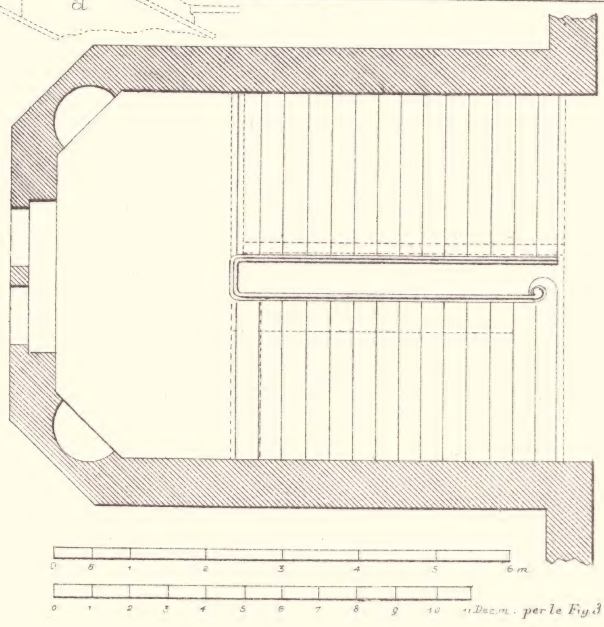


Fig. 4

Fig. 2.



Stabilimenti Riuniti d'Arti Grafiche MILANO

Scala della R. Scuola Leibniz in Hannover

Fig. 2 *Attacco delle travi alla colonna I*

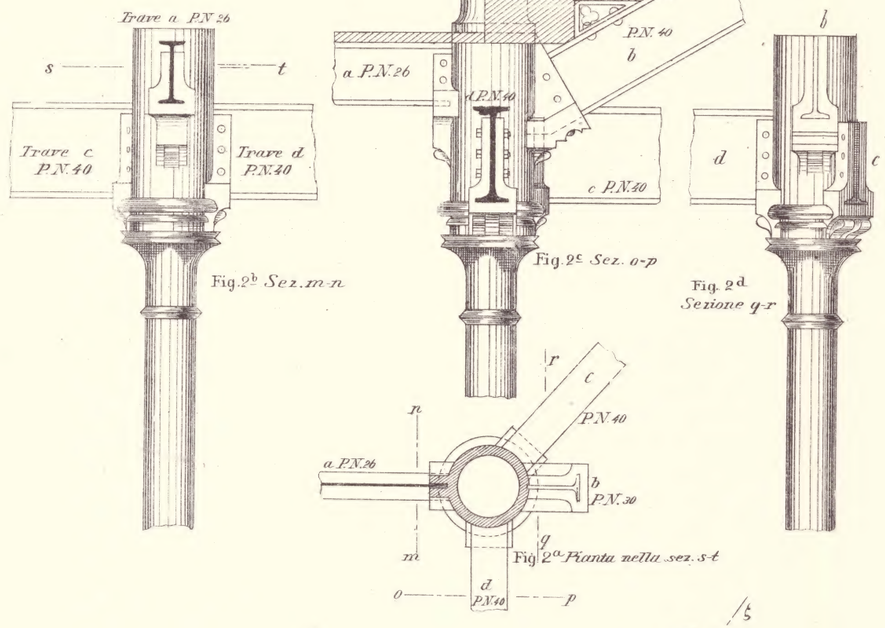


Fig. 2b *Sez. m-n*

Fig. 2c *Sez. o-p*

Fig. 2a *Pianta nella sez. s-t*

Fig. 2d *Sezione q-r*

Fig. 3 *Attacco delle travi alla colonna II*

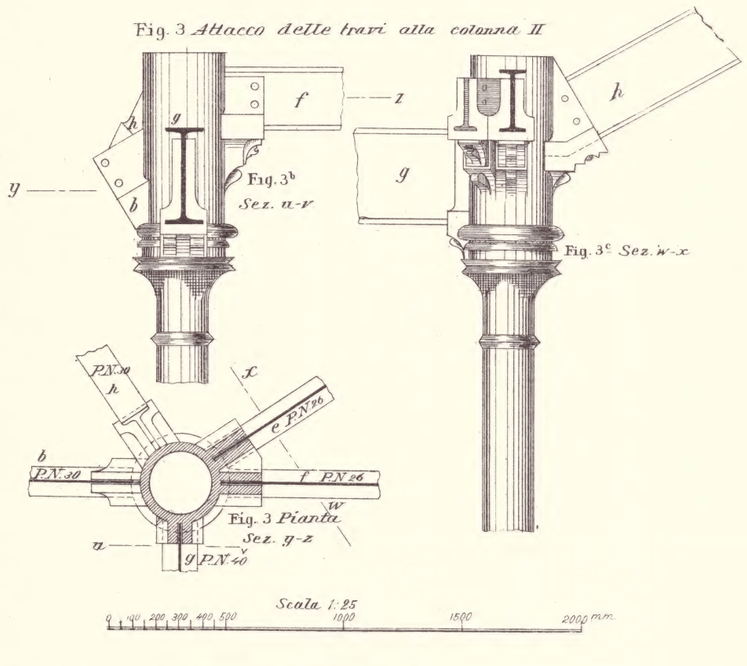


Fig. 4 *Attacco delle travi alla colonna III*

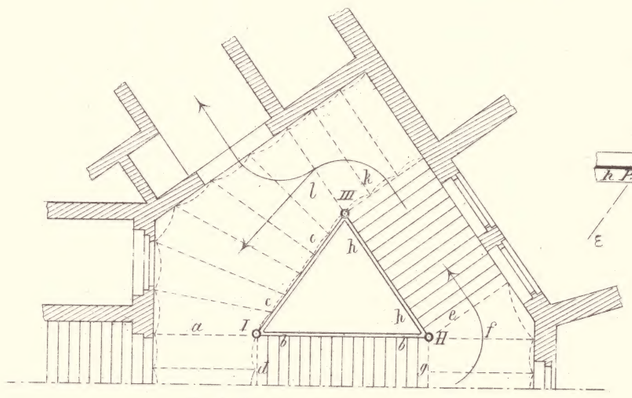


Fig. 1 *Pianta 1:150*

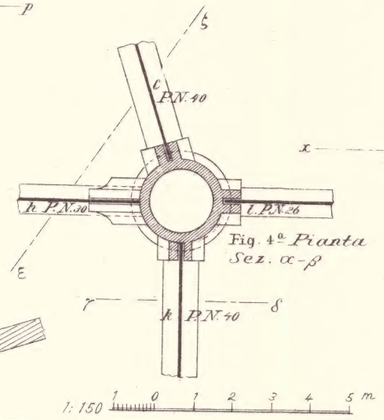
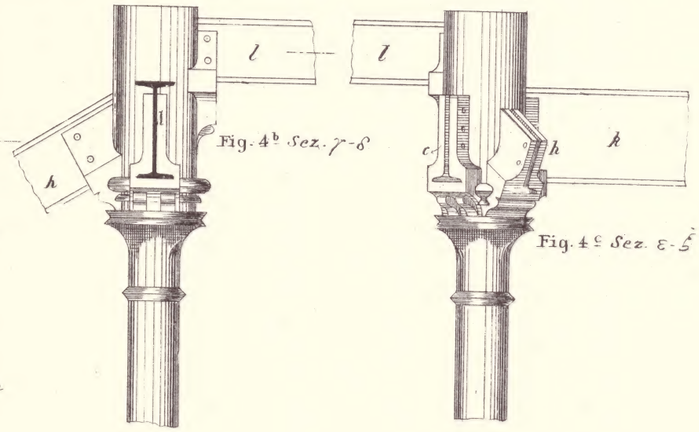
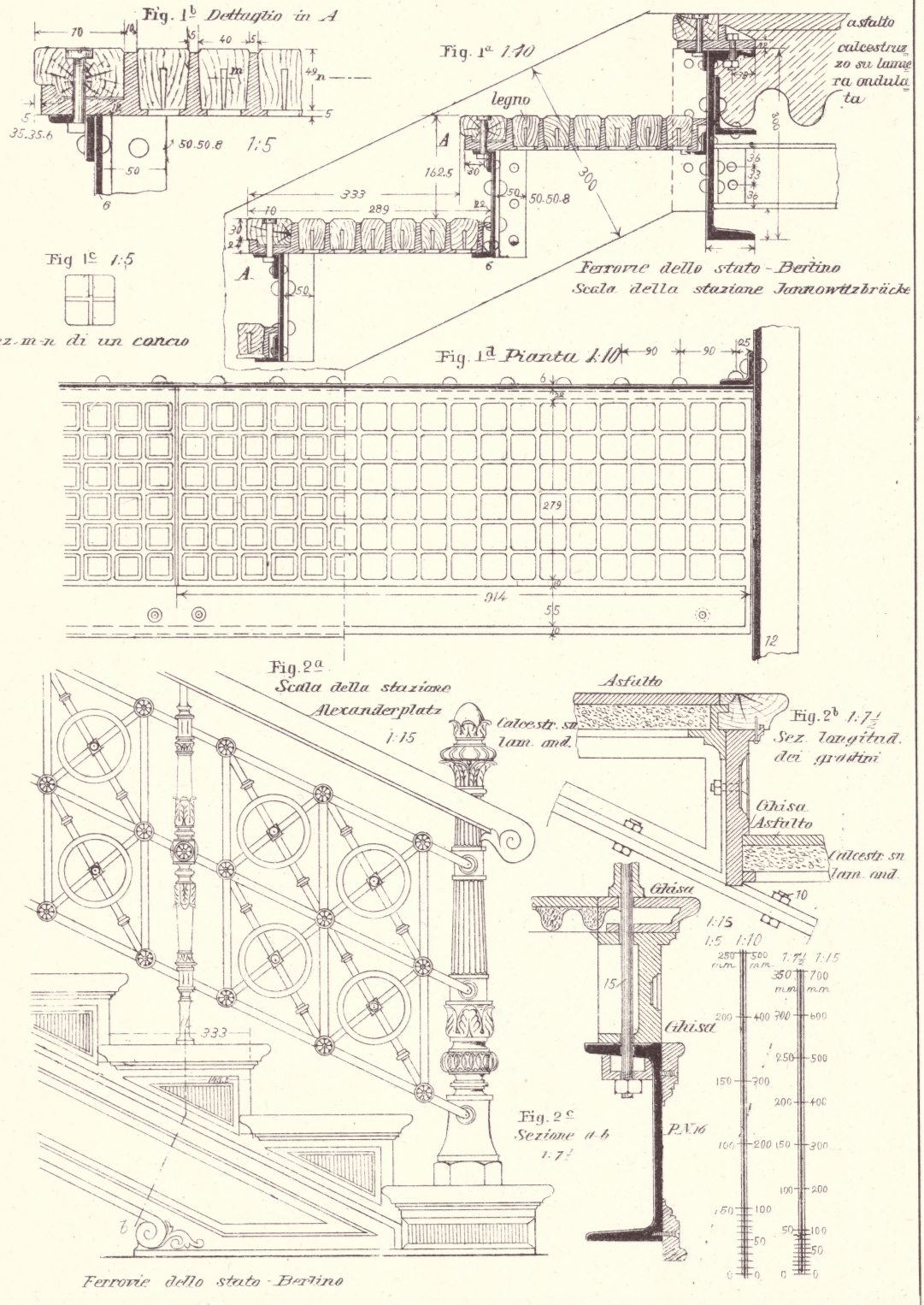


Fig. 4a *Pianta*
Sez. α-β



Stabilimenti Riuniti d'Arti Grafiche MILANO

Scale in ferro



Stabilimenti Riuniti d'Arti Grafiche MILANO

Scale in ferro forgiato

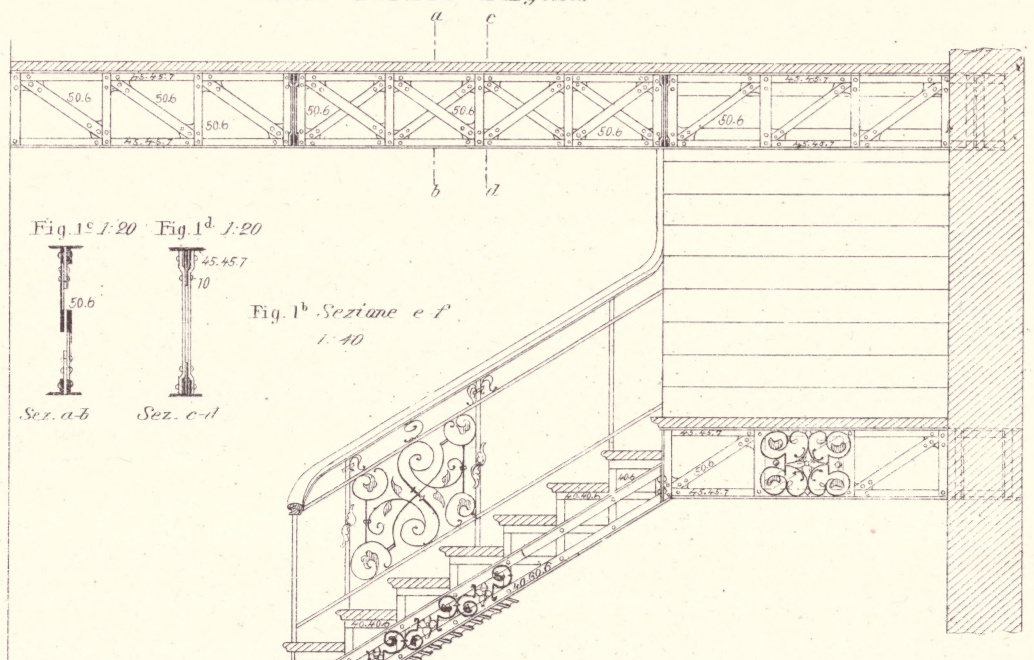
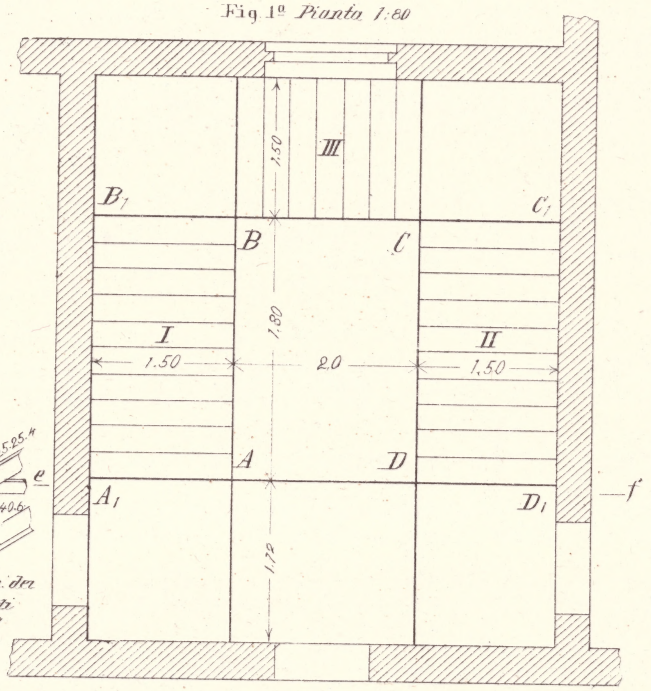


Fig. 1b Sezione e f
1:40

Fig. 1c 1:20 Fig. 1d 1:20

Sez. a-b Sez. c-d

Fig. 1a Pianta 1:80



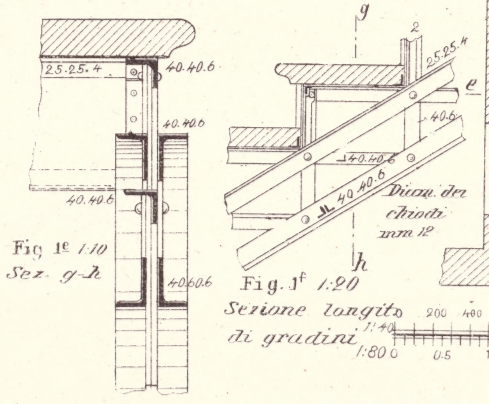
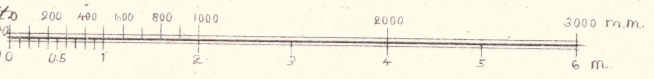


Fig. 1e 1:10
Sez. g-h

Fig. 1f 1:20
Sezione longitudinale di gradini



Stabilimenti Riuniti d'Arti Grafiche MILANO

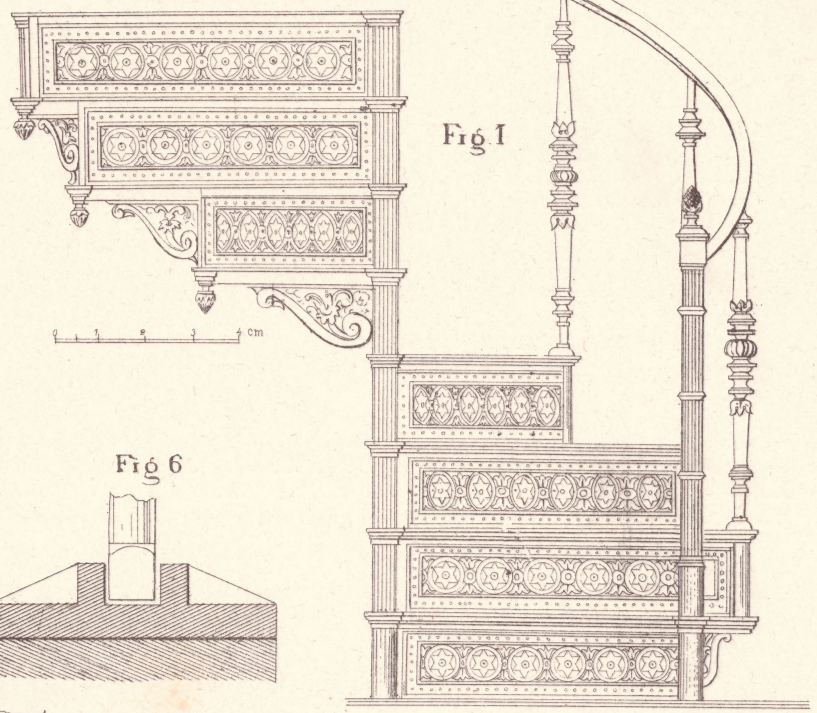
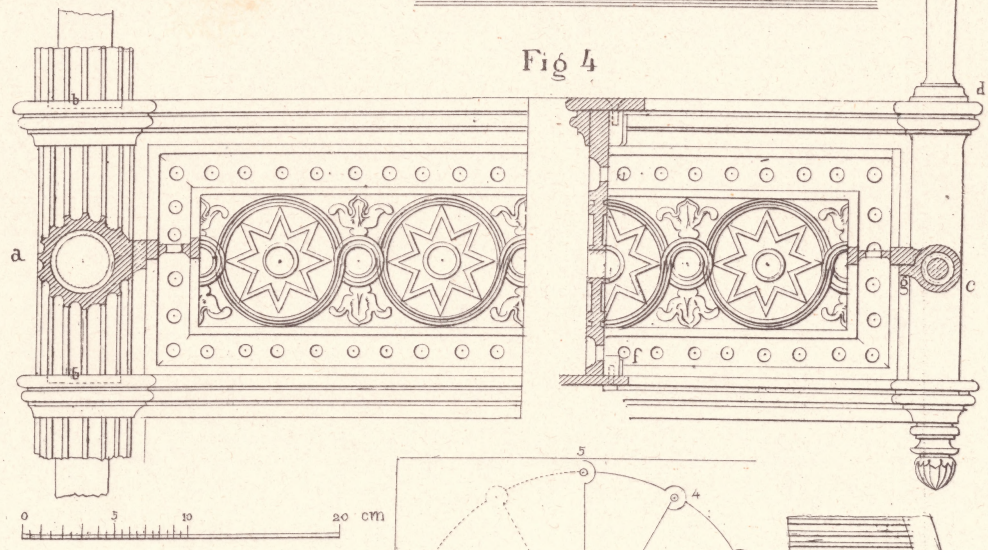
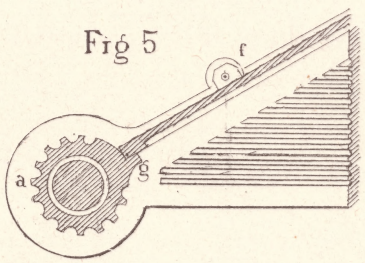
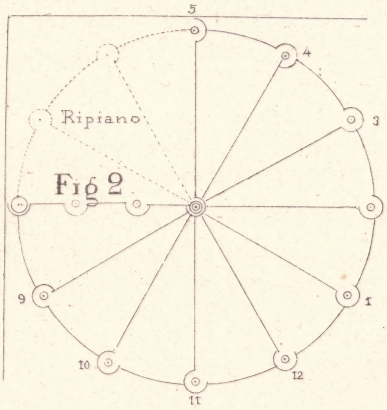
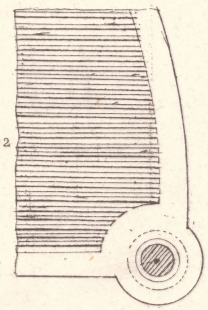


Fig 6









Breymann III

Stabilimenti Riuniti d. Arti Grafiche - MILANO